AMERICAN MACHINIST

JULY 9, 1942

Jigs and Dies F... ...lastics

Armament Se... ...for Air...

THE VITAL FRONT:

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LANSING
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Phone State 6856

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9 Engineering and Service Offices

Wherever there is an industrial area you will find a Heald Service Branch manned by Heald engineers ready to assist you in your precision finishing problems.

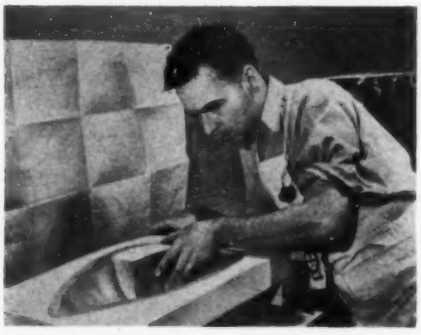
Trained for the job of service and customer assistance they know the answers, or where there is a question of doubt will immediately get in touch with the home office. Here there are innumerable records from 40 years of precision finishing experience leaving little chance but what your requirements will be met.

Make our Service Office part of your organization.

The HEALD Machine Company, Worcester, Mass., U. S. A.

AMERICAN MACHINIST

July 9, 1942



New Tools—Vega speeds aircraft tooling through novel applications of cast plastics in making its jigs and dies

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VOLUME 86 — NUMBER 14

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PRINTED IN U. S. A.

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"We find AMERICAN MACHINIST Essential to War Production"

. . . is Today's Cross Section of Comment From Metal-Working Production Executives

Helpful to plane production

"Many valuable items on tooling and conversion methods have been very helpful in our large expansion program for the production of airplanes."

—Asst. Director of Mfg., Plane Manufacturer

Read in valuable "leisure" time

"It would be hard for me to contemplate continuing in business without the services of *American Machinist* . . . it is delivered to my home and read during my so-called leisure time. With leisure time as valuable as it is today, you may be able to realize the value I place upon your magazine."

—Factory Mgr., Gear Equipment Manufacturer

Assistance in war work

"We are now 100% on war work and through information obtained in your magazine, material assistance has been given in meeting deliveries on contracts by the installation of the right equipment to do the job."

—Asst. to the President, Steel Manufacturer

Advertisements important

"*American Machinist* has been very helpful to us in giving information on all types of manufacturing methods, and the advertisements have been considered of equal importance to the engineers, draftsmen, men in the factory and Purchasing Dept."

—Executive, Instrument Manufacturer

Completely reliable source

"We have found it increasingly necessary to keep abreast of the times in the development of special tools for producing all types of war materials . . . *American Machinist* has been an invaluable aid in all phases of our work. We consider it a completely reliable source to which we can turn with confidence at all times."

—Chief Engineer, Tool Company

Armament Articles Valuable

"Your Armament production articles have been of great value to our tool designers and have saved us days and even weeks of development work."

—Chief Engineer, Cotton Machinery Company

Saved costly experiments

". . . Recently one of the articles on 'Methods of Cam Milling' rescued us from a series of costly experiments with our own ideas . . . our defense work consists mainly of fire control instruments, tank periscopes and telescopes . . . we would rather part with all the magazines in its class than to have to give up *American Machinist*, and that is the opinion of all the tool designers in our employ."

—Chief Tool Designer, Instrument Manufacturer

Every copy filed

". . . We have always found *American Machinist* very useful and have filed every copy for reference. It has been a wonderful aid in keeping abreast of new products and developments. When we established a War Production Department recently we employed many *American Machinist* ideas to advantage."

—V. P., Thermos Bottle Manufacturer

Useful Armament data

". . . we had occasion to estimate the operations and cost for clip for 50 calibre cartridge and found your die layout on this very helpful . . . we also found your layout of tools and method of manufacture of shells very helpful."

—Gen. Mgr., Brass Company

Ideas From Practical Men

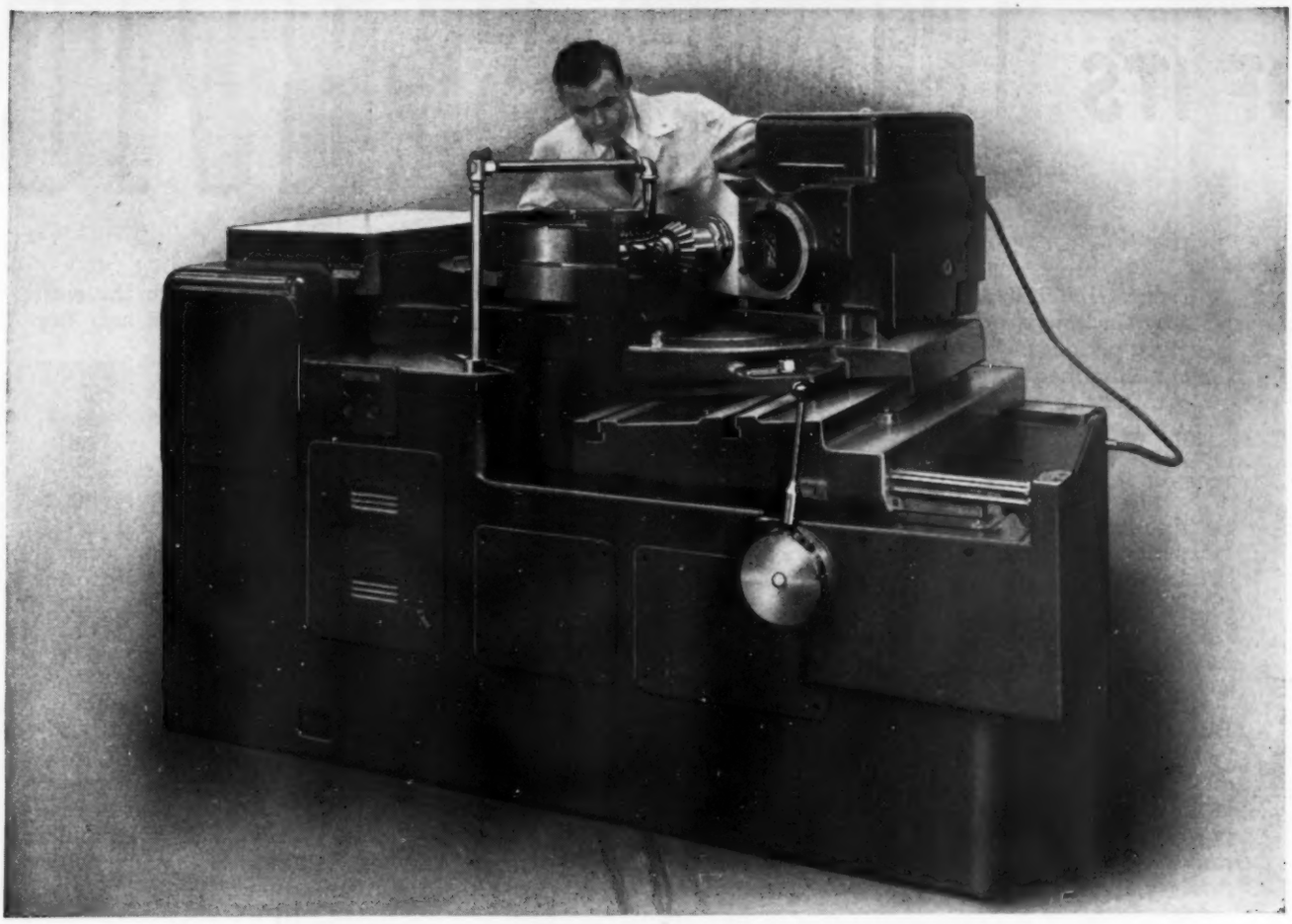
"I personally received much desired information from many of your subjects, including the advertisements, but 'Ideas From Practical Men' would be one part I would miss very much."

—Asst. Gen. Mgr., Screw Manufacturer

THE ESSENTIAL TEXTBOOK OF WAR'S ESSENTIAL INDUSTRY

Tech

GLEASON ANNOUNCES AN ENTIRELY NEW METHOD AND MACHINE FOR ROUGHING STRAIGHT BEVEL GEARS

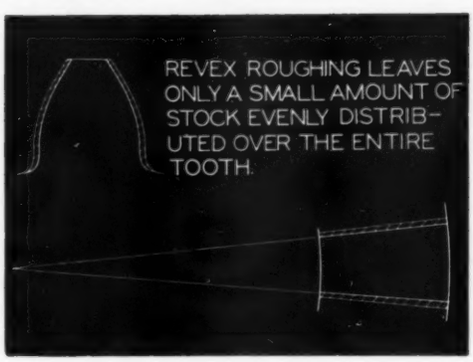


GLEASON No. 7 REVEX STRAIGHT BEVEL GEAR ROUGHER

On the new Revex Rougher, straight bevel gears are roughed closer to finish size than on any other roughing machine.

The Revex produces both the proper tooth taper and profile shape by the combined effect of the cutter motion and form of the cutter blades. Only a small amount of stock, evenly distributed over the entire tooth, is left for the finishing operation.

Revex Roughing is faster than other methods, and with the close roughing obtained, Gleason Generators finish-cut fully 30 to 40 per cent faster.



Send prints for complete information on how the Revex Rougher can increase your capacity and decrease your gear-cutting cost.

SPECIFICATIONS

Maximum Pitch Diameter (6 to 1 ratio)	14″
Coarsest Pitch	3 D. P.
Greatest Face Length	2″
Extreme Ratio (shafts at 90°)	6 to 1
Index Range	13 to 100 Teeth
Feed Rate	4 to 33 sec. per Tooth
Floor Space	40″ x 85″

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

IF IT'S LONG SERVICE

● Every CINCINNATI No. 0-8 Plain Automatic Milling Machine is built to give dependable service over long periods of time. In designing and building these milling machines a great deal of attention was given to lubrication. In the No. 0-8 this important feature is complete, automatic, positive and foolproof, and accounts in a large measure for the extra years of service you may expect from these millers.

Because lubrication is fully automatic even the most inexperienced operator cannot harm the No. 0-8 by overlooking the oiling of important bearings. All that is required is an occasional cleaning of the filter. Relieving the operator of lubrication worries permits him to concentrate all his time and attention on the operation of the machine.

But Long Service is only one of many benefits. The No. 0-8 equipped with automatic Rise and Fall spindle carrier is exceedingly versatile, possessing the power and flexibility to mill a wide range of small parts quickly, accurately and economically. Operation is simple. Load the fixture, flip the starting lever and the machine goes through the entire operating cycle automatically, returning and stopping the table at the starting position.

The No. 0-8 is especially desirable where it is not possible for work to traverse directly into the cut because the Rise and Fall spindle carrier enables the machine to take obstruction jumps automatically. And to change operating cycles simply change the automatic cycle selectors. These cycle selectors are camshaft assemblies by which almost any conceivable operating cycle may be automatically established. Replacing one cycle selector with another is a simple procedure and requires only a minute or two.

If you mill small parts and want machines that will be giving unfailing, trouble-free performance long after this war is over, buy CINCINNATI No. 0-8 Plain Automatic Milling Machines. You'll be interested in all the facts about these versatile, long-lived millers. Send for Specification catalog M-964 which gives complete details on all features and why they are beneficial to you.

CINCINNATI No. 0-8 Plain Automatic Milling Machine equipped with automatic Rise and Fall Spindle Carrier is shown in the illustration at right. Be sure to send for Specification catalog M-964.

WIN *with a Cincinnati!*

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

YOU WANT

CINCINNATI

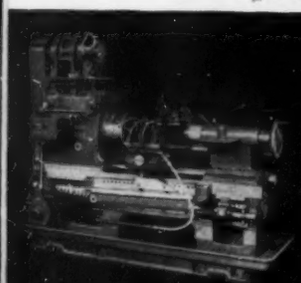
BUY CINCINNATI No. 0-8 PLAIN AUTOMATIC MILLING MACHINES

IN a great circle of covered wagons silhouetted like ghostly galleons in the firelight, they held a council. And that night—somewhere west of Laramie, in the fall of '49—twenty-seven families elected to seek a short-cut to California. With the courage of hope and their own stout hearts, they would blaze a new trail west.

Five months later, on the rim of an impassable waste which they named Death Valley, the remnant of this brave little party killed their weakest oxen for food, burned their wagons to dry the meat, and set out—still westward—on foot. They faced death from hunger, thirst, and the arrows of Indians. They carried only the barest essentials. Yet a full 20 pounds of each man's burden was his rifle and ammunition. . . . Upon that, and upon courage, they depended for survival.

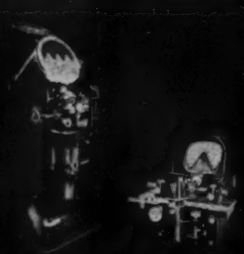
This is only one of many sagas of the famous Forty Niners that have echoed like distant thunder down the years. And it is interesting that the principal character in most of those dramas of survival was a rifle known as the Windsor, 54-caliber, built by Robbins and Lawrence. For this was the finest weapon in the world—a gun so perfectly made that all its 60 parts were precise for interchangeability. Such a feature was unique in that early day, made possible only by the highest standard of precision manufacture. . . . The tools that made that famous firearm helped to make American history!

Today, history is once more in the making, and tools are once more helping to make it. Many years ago, Robbins and Lawrence grew into the Jones & Lamson Machine Company. Through nearly a century, the skills, the knowledge and the tradition of that early American company have been constantly advanced. And the result is once more precision machine tools that are being used to make the finest weapons in the world.



FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

WHO WERE THE SURVIVORS IN '49 ?

TODAY, the man at the lathe is as truly engaged in defending those who depend upon him as was the armed pioneer of 1849. And being expert himself, this man appreciates the skill that produces a Jones & Lamson precision machine tool, just as his keen-eyed, self-sufficient ancestor appreciated the perfection of his Windsor rifle.

This skill, and the knowledge behind it—the results of nearly a century of constant development and improvement in precision machine tool design—is always at your disposal. No matter how great or how small your problems, both now and after this war, they will receive the careful attention and detailed study of our engineers.

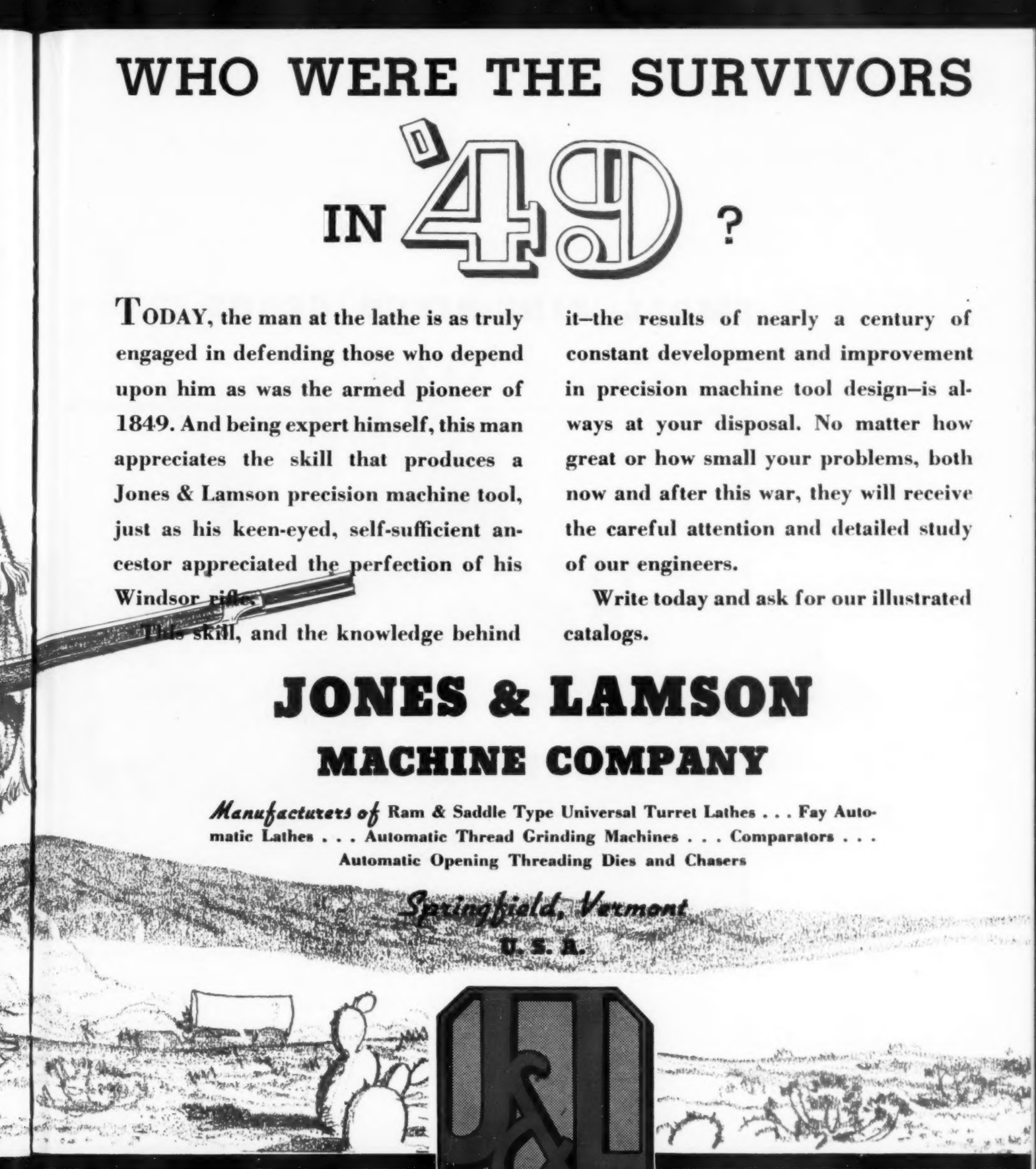
Write today and ask for our illustrated catalogs.

JONES & LAMSON MACHINE COMPANY

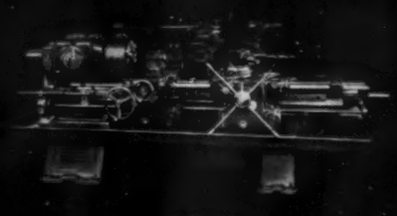
Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

Springfield, Vermont

U. S. A.



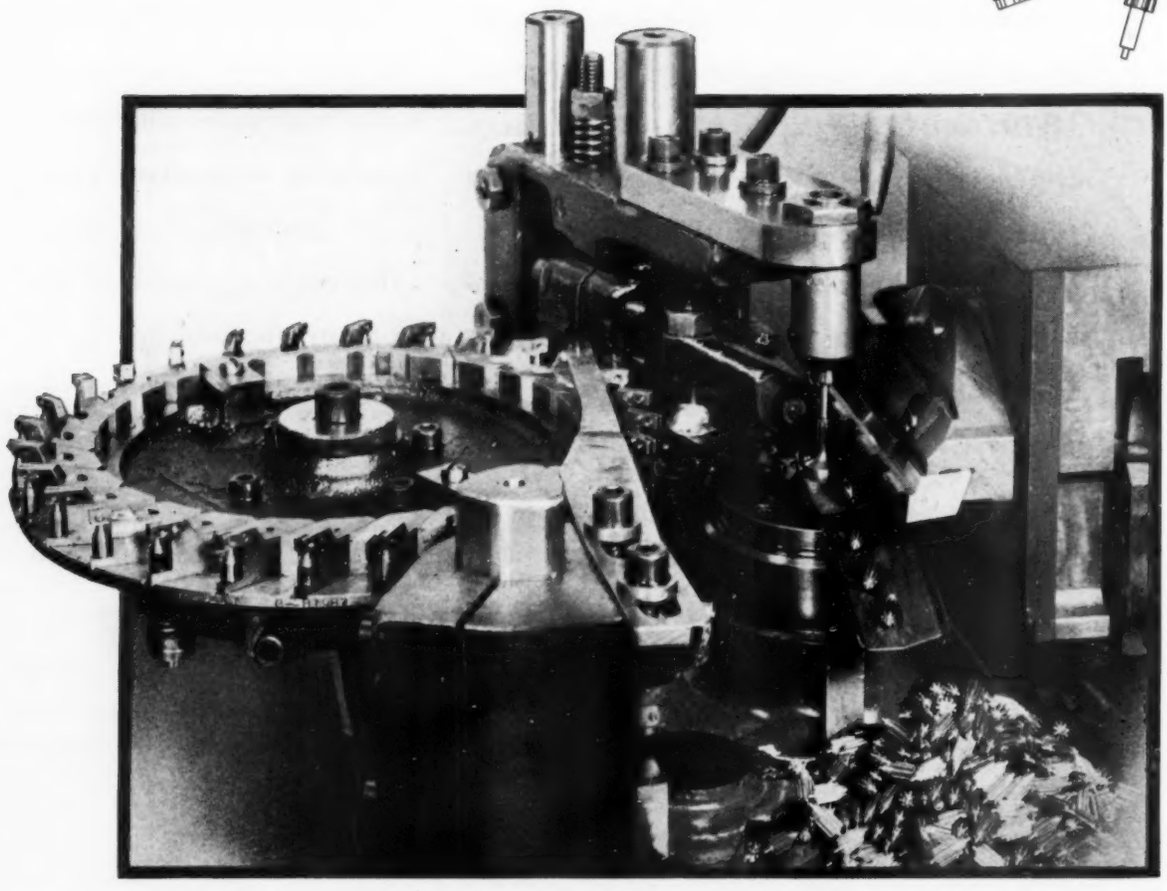
PROFIT PRODUCING MACHINE TOOLS



SADDLE TYPE UNIVERSAL TURRET LATHE

RAM TYPE UNIVERSAL TURRET LATHE

SMALL, FINE-PITCH GEARS



Magazine loading is particularly well suited to the handling of stem pinions, or thin blanks, when ganged on arbors. Work is loaded in magazine by hand, but is automatically ejected. Note the STRAIGHT LINE Cutter which for tiny pinions is made with "gaps" rather than with a continuous row of teeth.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

PRECISION CUT *FASTER*

THAN WITH SUB-PRESS DIES . . .

The Fellows STRAIGHT-LINE GEAR GENERATOR employs a rack-type cutter, which is admirably suited to the generating of a variety of gear-tooth forms, in addition to those of involute shape. When equipped with a magazine feed, this machine produces gears and other parts at a phenomenal rate of speed.

A further advantage of this machine is that it is especially suited to the cutting of small fine-pitch pinions, for which work the rack is made with a series of rows of teeth separated by gaps. Sharpening of the cutter, especially when provided with straight, or spur teeth, is a simple job of surface grinding.

These machines are used extensively for cutting gears for clocks, cameras, dial indicators, range finders, time fuses, etc. . . . For descriptive catalog, write The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, Michigan, or 640 West Town Office Building, Chicago, Illinois.

Method

. . . . FROM BLANK TO FINISHED GEAR

...if it's LONG

BUY CINCINNATI HYDRAULIC UNIVERSAL

● The ability to deliver accurate performance over long periods of time is inherent because into every CINCINNATI Hydraulic Universal is built that intangible quality — longevity.

In addition to precision construction, the greatest contributing factor to Long Service is foolproof lubrication. In these grinding machines every power mechanism is either pressure lubricated or completely submerged in oil. And oiling is principally a function of the machine and not entirely dependent upon the operator. Foolproof lubrication assures smoothness of operation, low maintenance and continued accuracy over long periods of time.

Many years after this war is over the CINCINNATI Hydraulic Universals that are turning out war essentials today will be working around the clock producing peacetime requirements, and giving the same dependable service.

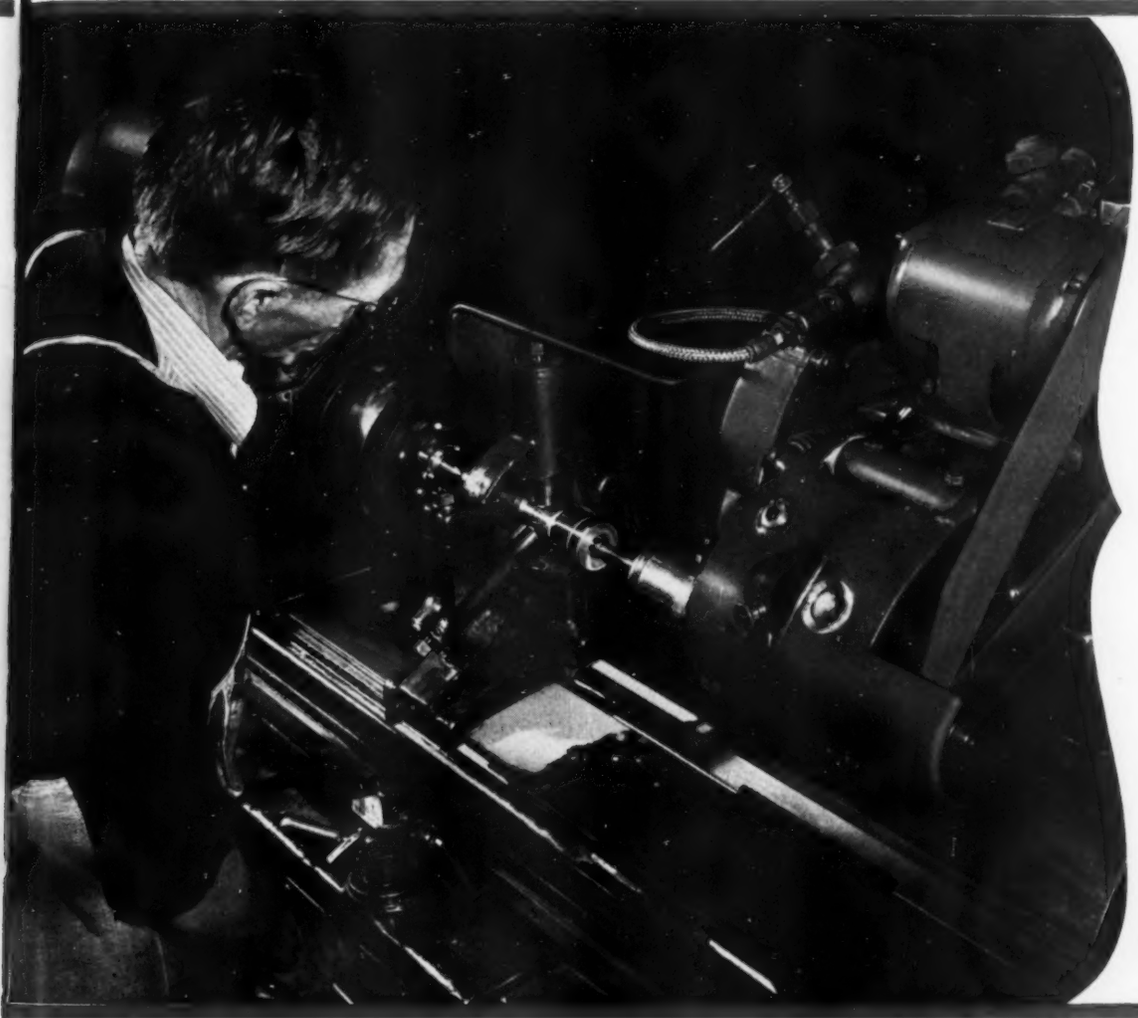
So if it's Long Service you want, buy CINCINNATI Hydraulic Universal Grinding Machines. Not only will they give dependable performance for many years, but they assure Faster Set-up, Faster Handling, Faster Grinding and Faster Sizing. Further, extreme accuracy is easily and quickly achieved — tolerances of .0001" being practical. These machines are ideal for your toolroom grinding and general manufacturing work. There is a size to fully meet your requirements because Hydraulic Universal Grinders are available in 12", 14", 16", and 18" swings and between-center distances up to 72".

Specification catalogs G-486 and G-474 give complete details on all features and their benefits. Send for your copies today.

WIN *with a Cincinnati!*

SERVICE *you want*

GRINDING MACHINES



● In the illustration at the left the operator is grinding the bore in a short shaft to an accurate plug-gage fit. This is a good example of the function of the Internal Grinding Attachment which is driven by an independent motor and is standard equipment on all Hydraulic Universals. There are many other unusual features you're going to like and want. Get all the facts. Be sure to send for Specification catalogs G-486 and G-474 which give complete details.

CINCINNATI

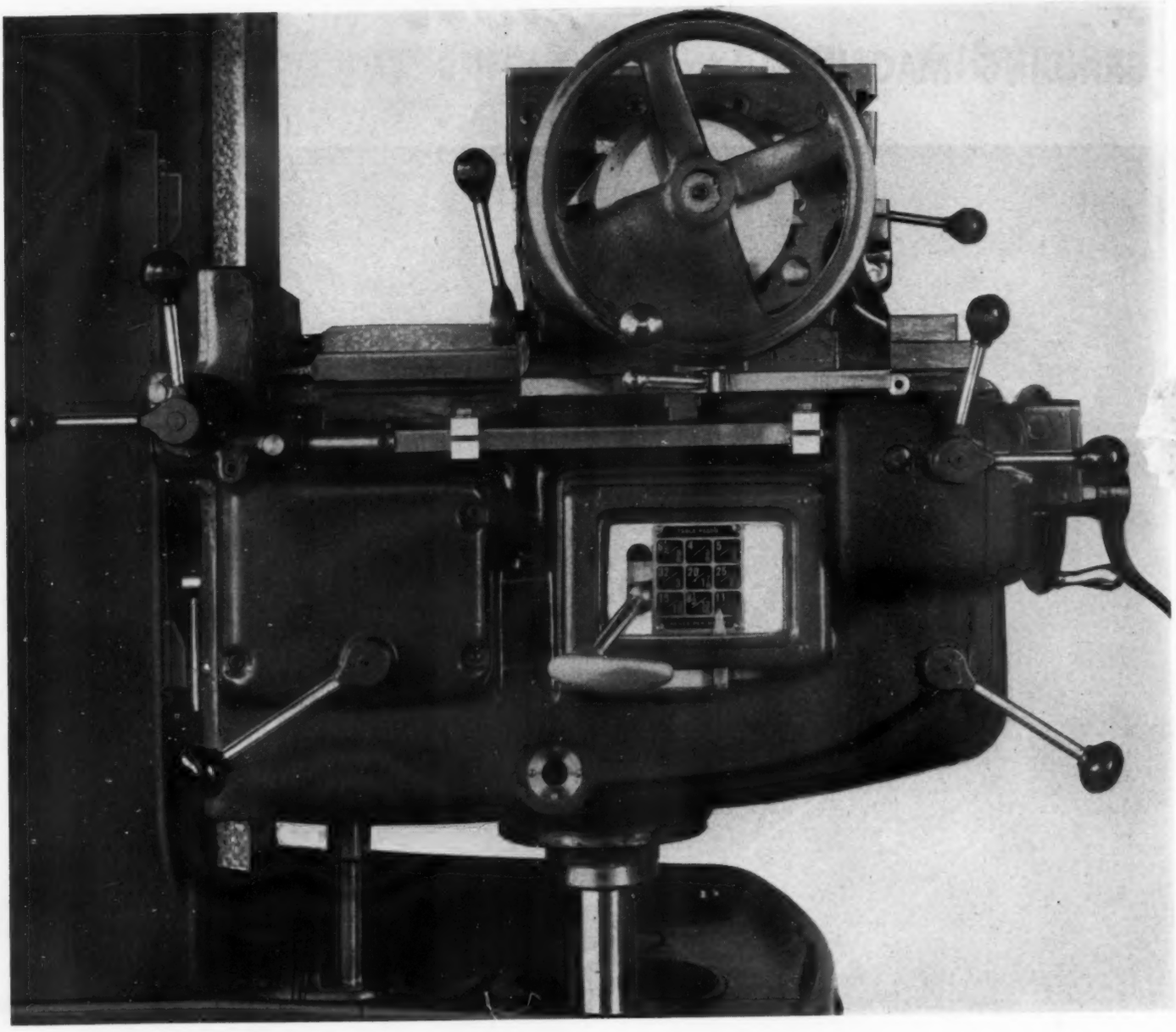
CINCINNATI GRINDERS INCORPORATED

Cincinnati, Ohio U. S. A.

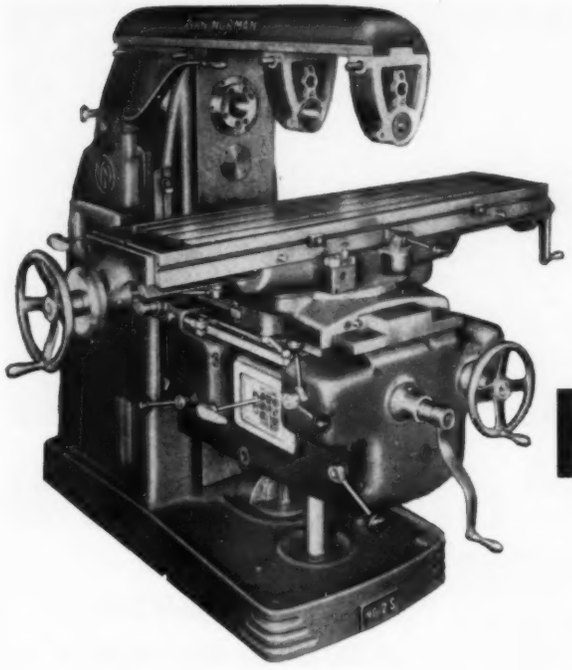
CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES

All Power Controls Are

RIGHT AT YOUR FINGERTIPS...



VAN NORMAN MACHINE TOOL COMPANY . . .



on Van Norman Horizontal Millers

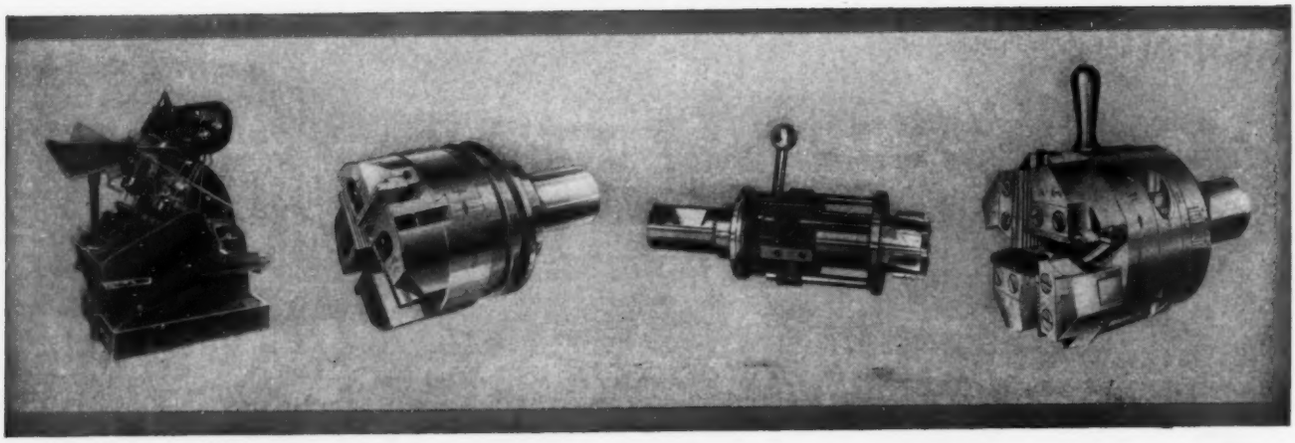
Centrally, conveniently grouped together are all the power-controls of Van Norman Horizontal Millers. And their proper use is never confusing to the operator. For whether he is at the front or back of his machine, he has only to move the levers in the direction in which he wishes to travel the table, knee or saddle. And to change to any of the 18 feeds, he has only to move the single lever-selector to the desired feed indicated on the direct-reading dial. This quick ease of operation enables Van Norman's No. 2-S and 3-S Horizontal, No. 26 and 36 Ram type, and No. 3-V Vertical models to establish new horizons of accuracy and output in horizontal milling operations.

★

On June 20th, Van Norman was awarded the Army and Navy Star, in recognition of the company's war production record.

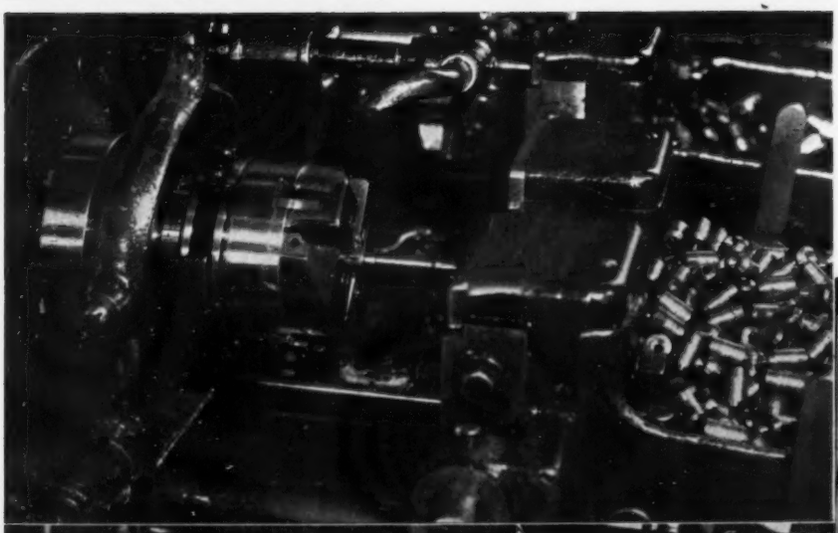
SPRINGFIELD, MASS.

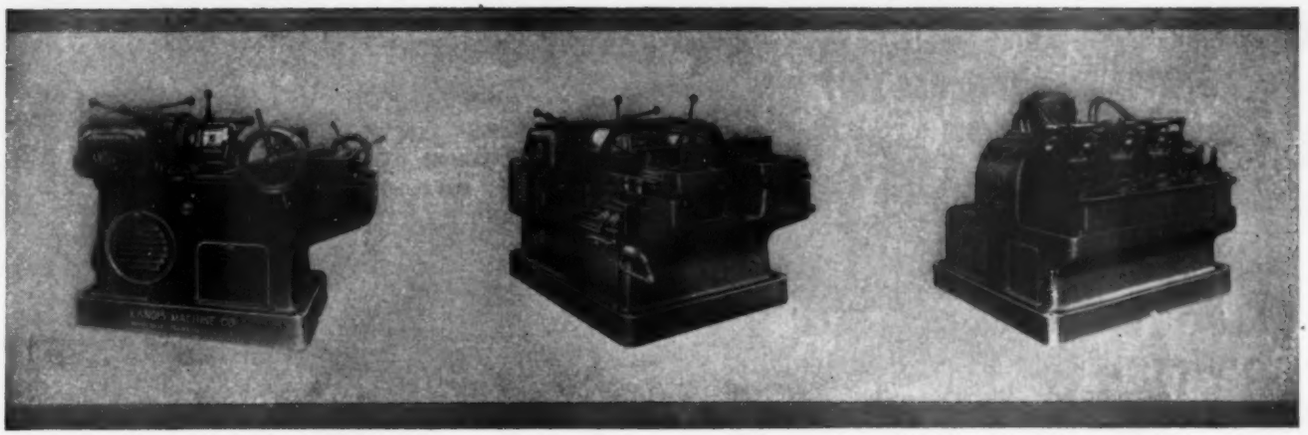
VAN NORMAN
Milling Machines



LANCO Heads Assure

BE THREADWISE
LANDISize for Higher Production at Lower Cost





Low Threading Cost

The set screws which are threaded on the LANDMACO Threading Machine equipped with LANCO type V Heads, illustrated—range from ¼" diameter to 1¼" diameter. The screws are all made from 3140 S.A.E. coldworked bar steel. Threading at a cutting speed which ranges from 72 R.P.M. to 392 R.P.M. depending upon the diameter which is being threaded, an average of 250 screws, Class No. 3 fit, are threaded per hour. Several thousand screws are threaded per chaser grind. Such performance leaves but one conclusion—THREADING Cost must be low.

Investigate the advantages of using LANCO Heads for handling your threading operations. Write for our Bulletin No. F-80 today.

The LANDIS *Line*
PRECISION Thread Grinders

STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS

CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

LANDIS MACHINE COMPANY, Waynesboro Pennsylvania

"AMERICAN"

FOR ALL-OUT PRODUCTION

Records Made and Broken Everyday!

"AMERICAN" Hole Wizard Radials are really "goin' to town" on aircraft crank cases. We have reports almost every day from leading airplane engine plants of new records being made and then broken by these "Newest New Radials."

Drilling, reaming, spot facing, boring, tapping—in fact, every kind of work that a Radial Drill will do is handled quickly, easily and at record speed on the "AMERICAN" Hole Wizard.

New Bulletin No. 328 tells the story.

THE AMERICAN TOOL WORKS CO.

CINCINNATI, OHIO, U. S. A.

"AMERICAN" *Hole Wizard* RADIALS

LATHES RADIALS SHAPERS

ARMSTRONG

Over 96% of the Machine Shops and Tool Rooms are SAVING 90% of their High Speed Steel

By using ARMSTRONG TOOL HOLDERS 96% of the Machine Shops and Tool Rooms, "Save: All Forging, 70% Grinding and 90% High Speed Steel." This means that in the United States each pound of this valuable cutting metal will produce 10 times as much as it will in countries dependant on forged tools. Each ounce of high speed steel used in an ARMSTRONG TOOL HOLDER will machine as much as 10 ounces of high speed steel in a forged tool.

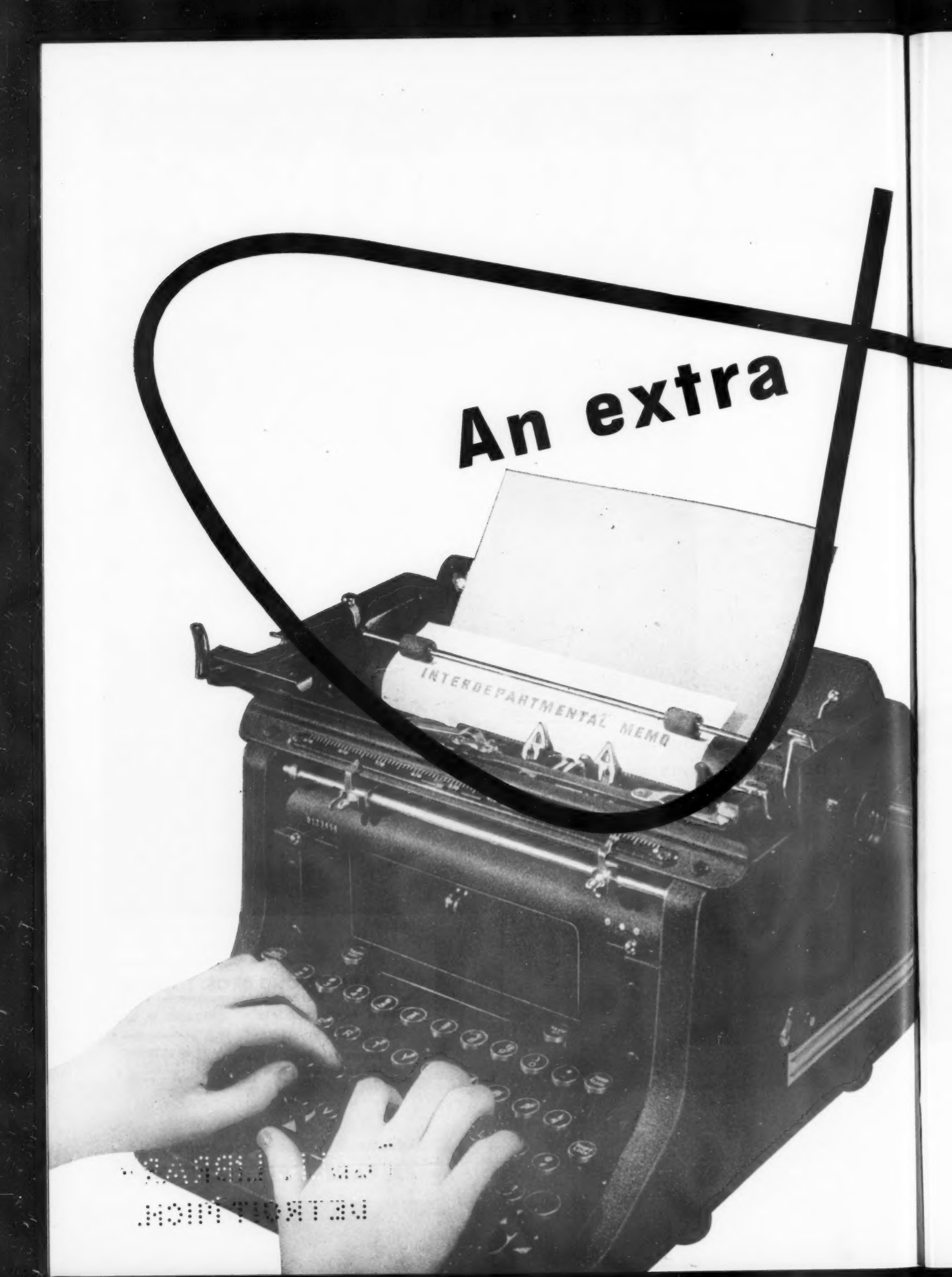
ARMSTRONG TOOL HOLDERS speed production in other ways. By reducing "tooling-up" to the selection of a cutter, and adjustment for clearance, and by eliminating all "tool dressing," they keep machine tools running. Because of their greater efficiency and extra strength they permit far higher speeds and feeds. By using ARMSTRONG TOOL HOLDERS for every operation on every lathe, planer, slotter and shaper you can get the absolute maximum from every machine tool, can increase war production and save valuable high speed steel.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

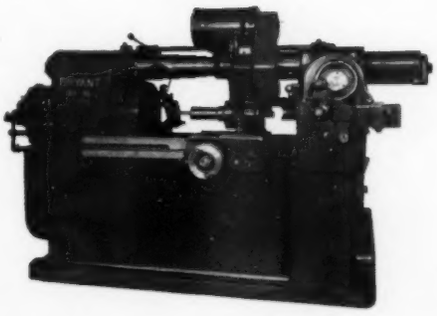
Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms


An extra
INTERDEPARTMENTAL MEMO

carbon for Bryant

On memorandums — notes — specifications that cover jobs demanding internal grinding, it is easy to issue standing instructions to make "an extra carbon copy for Bryant."



Right from the earliest stages of development on internal grinding work, Bryant engineers can use this information to study new ways to combine operations, cut costs and save time for you.

Whether your problem is one of urgent, immediate production for defense or far-sighted planning for post-war profits, Bryant engineers are ready to cooperate with your own staff. Bryant productive capacity, already tripled, is constantly increasing. Bryant engineering service is setting the pace on internal grinding today.

The more information you place in the hands of Bryant engineers, the more they can help to push costs down and profits up on internal grinding work for you. Make "an extra carbon for Bryant."

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

This multiple spindle machine is used to rough-and-finish cut the bottom, sides and dovetails of milling machine tables . . . In one "pass" through the machine, it performs a number of machining operations at high speed and with unusual precision. It climinates many operations formerly requiring several separate machines . . . This unit is another of many specialized production machines designed and developed by Kearney & Trecker engineers to manufacture their own product — Milwaukee Milling Machines — in volume and to the highest standards of machine tool accuracy.

Milwaukee MACHINE

Rapid training of milling machine operators is an acute need today. As an aid in that direction we offer "Milling Practice" — a visual training course that has proven of real value and is in use throughout the country. For information — write our Department of Industrial Education.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U. S. A.

KEARNEY & TRECKER
CORPORATION

T O O L S

THE TOOLS YOU BUY AGAIN
Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

BUY UNION TOOLS ON FAITH

...and you'll use them for RESULTS

You can come to UNION for your small tools on faith in the organization behind them. Once you've put them to work you'll find full justification for your confidence. Consistently fine performance in terms of better, faster work at lower cost is your reward for taking our word and the word of countless users for the fact that UNION sets high standards for quality and results.

UNION has maintained its leadership in small tools over a period of many years—tools that are recognized everywhere for uniformity, dependability and long-lived productivity—tools that give faithful, economical performance. Prove them by using them.

UNION TWIST DRILL CO.

Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

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S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

Representatives throughout the world

UNION

AUTOMATIC CHUCKING EQUIPMENT

tooled for today's fast tempo . . .

Photo by U. S. Army Signal Corps

For over 40 years a pioneer specializing in the development of ways and means to improve and speed up production of duplicate parts, Potter & Johnston now takes a prominent place in the tremendous war effort in which metal working industries are engaged.

P&J Automatic Chucking Equipment has been going into the arsenals of democracy in a steady flow and is continuing to add to the productivity of these plants. Parts for all kinds of implements of war are being produced faster and closest degrees of accuracy on P&J machines. Whether for airplanes, tanks, Bofors guns, 90 mm. anti-aircraft guns, machine guns, adaptors for shells or the American Oerlikon gun, Potter & Johnston Chucking Machines are producing parts in ever-increasing volume but always to the highest standard of accuracy and finish demanded.

Potter & Johnston was ready with machines and tooling for the present emergency. We are ready at all times to render our utmost assistance on your production problems because we prepared yesterday to meet today's tempo.

The POTTER & JOHNSTON MACHINE CO.

PAWTUCKET . . . . . RHODE ISLAND

OHIO PRODUCTION
MILLING MACHINES

Profitable for short runs, because easy to set up, operate, get at, and change over. Profitable for long, steady grinds, because rugged, rigid, and built to last . . . Climb-cutting for longer service. Powerful, true cutter rotation, a true plane of travel, and positive locked feed make possible milling *against* as well as *with* the feed . . . Various cycles of automatic feed operation are available.

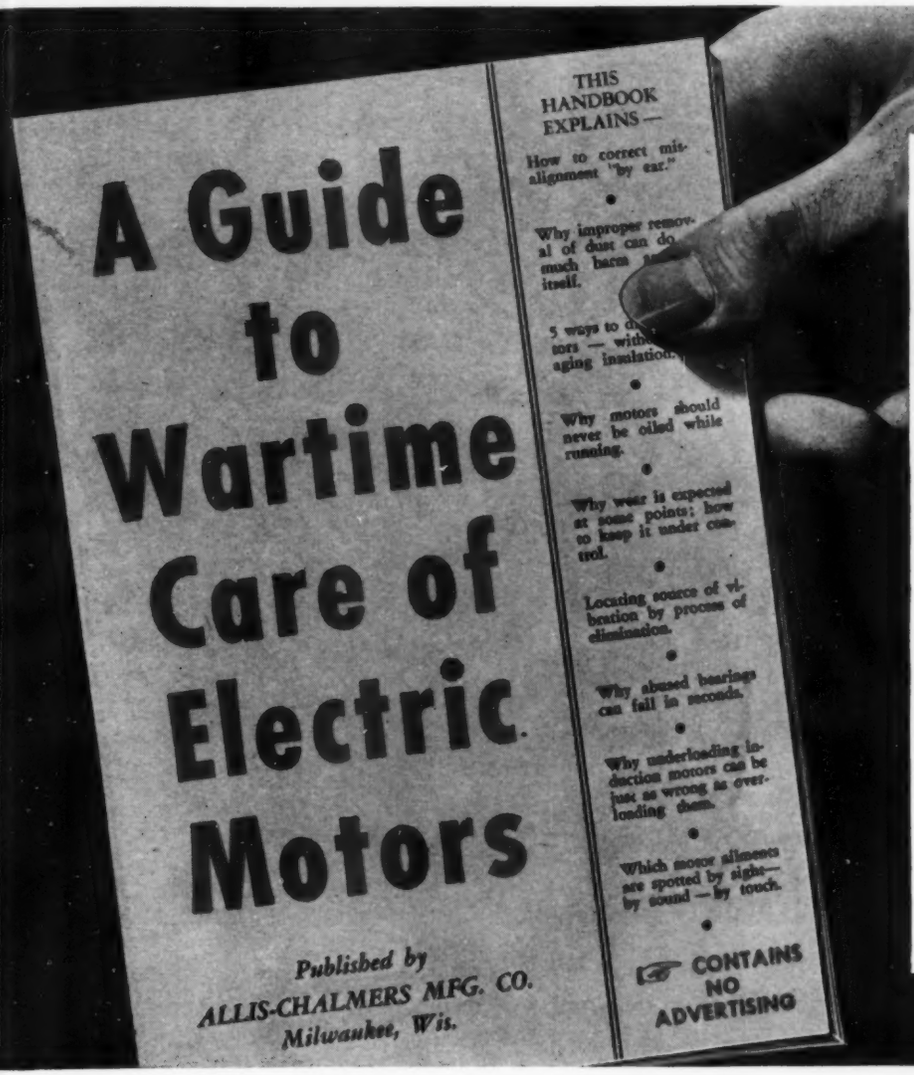
THE OHIO MACHINE TOOL COMPANY, KENTON, OHIO

Orders for this machine

OHIO DREADNAUGHT
HORIZONTAL BORING, DRILLING AND MILLING MACHINES • SHAPERS • PLANERS

Announcing

A VITAL NEW AID TO VICTORY PRODUCTION . . .


A Guide to Wartime Care of Electric Motors
THIS HANDBOOK EXPLAINS —
How to correct misalignment "by ear."
Why improper removal of dust can do much harm itself.
Why motors should never be oiled while running.
Why wear is expected at some points; how to keep it under control.
Locating source of vibration by process of elimination.
Why abused bearings can fail in seconds.
Why underloading induction motors can be just as wrong as overloading them.
Which motor ailments are spotted by sight — by sound — by touch.
CONTAINS NO ADVERTISING
Published by ALLIS-CHALMERS MFG. CO. Milwaukee, Wis.

Your Copy is Free!

ENGINEERS — production managers — maintenance men — executives . . . here's a valuable new handbook that you're sure to want for your technical library . . . a book designed to help you meet today's *new* motor maintenance problems!

And they *are* new problems . . .

Wartime's three-shift production has crowded *triple-duty* for motors into every day. New working days have been added!

All told, a motor's working time has skyrocketed since the emergency from 1800 hours a year to *8700 hours!*

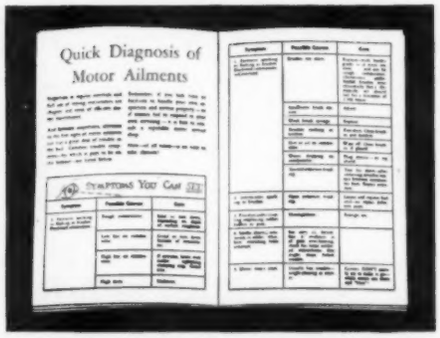
That means that inspection, adjustment, lubrication check-ups — all must be quadrupled . . . and must be geared up to wartime standards of efficiency!

To help you most, "A Guide to Wartime Care of Electric Motors" applies to *all* makes of standard, general-purpose motors. And it takes a *fresh* look at motor care.

For Allis-Chalmers recognizes — as you do — that maintenance "as usual" went out with Pearl Harbor.

Send for this Valuable new Handbook today

COMPLETELY ILLUSTRATED — Making principles of motor care crystal clear. Of particular value for training new men.



HANDY REFERENCE — Helping you catch motor troubles at early stage. Tear out order form and send for *your* free copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* "A Guide to Wartime Care of Electric Motors".

(Name)

(Title)

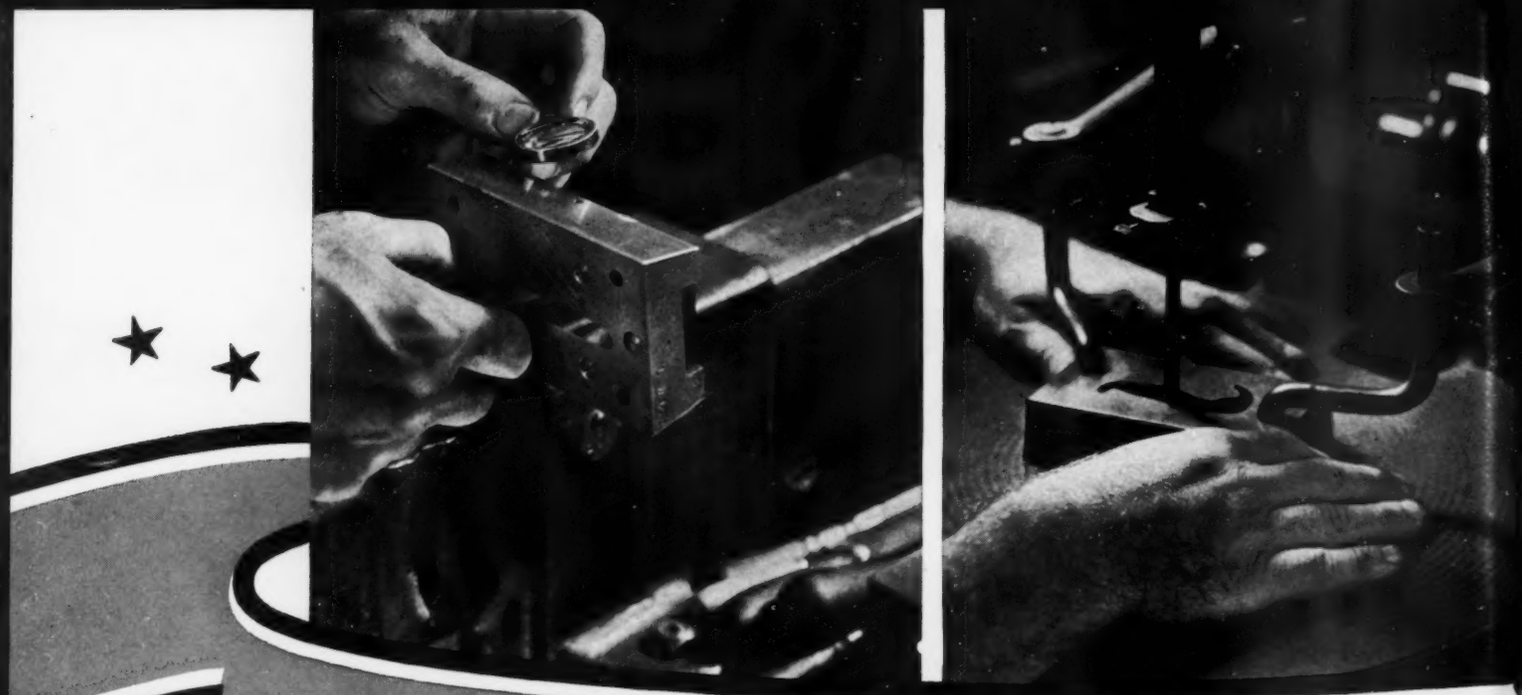
(Company)

(Street Address)

(City and State) A 1533-11

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE



ARE THESE Your BIG

May We Help You Find The Answers?

Pushing plant capacity above the old "maximum" while changing over to full Wartime production brings up a lot of tough problems, all at once. If you have more than your share of these problems brought on by TOTAL WAR—perhaps Carpenter's diversified experience with tool steel problems can help you out of some tight spots.

PROBLEM #1 — HELPING EVERY MAN PRODUCE MORE

Tools that crack in hardening or fail prematurely mean precious time *lost* in "doing jobs over". And that time *could* be made to yield *more* tools.

The Carpenter *Matched Set* program is helping to solve this problem by simplifying the selection and heat treatment of tool steel for each job. And to further step up the output of every skilled worker who contributes to the quality of your tools, Carpenter has published a 315-page handbook, "Tool Steel Simplified". Over 26,500 copies are now at work providing useful tips to help workers produce better tools faster. It answers questions on size change, warping, grinding checks and the relation of design to heat treatment. Whether or not you have an organized training program, "Tool Steel Simplified" can provide practical information for apprentices—and a good "refresher course" for skilled workers.

This is the handbook that is the guts of many plant programs for more production from every man and each machine. It is written in shop language so that trainees and apprentices will be able to understand it and apply it to their work. Available at cost to tool steel users in the U.S.A.—$1.00 ($3.50 elsewhere). Order your copy today.

THE CARPENTER STEEL CO.,

Carpenter

BRANCH WAREHOUSES AT—Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, Philadelphia.

PRODUCTION PROBLEMS NOW?

PROBLEM #2 — GETTING MORE OUTPUT FROM MACHINES AND PRESSES

Every time a machine or press is shut down for tool and die repairs or regrinding, you are losing valuable time that *can* be saved. The Carpenter Matched Set Method of selecting and heat treating tool steel has proved this in over 1,500 plants. Look at these typical reports: "*Output up 52,500 pieces per month*" . . . "*Production capacity of tools up 20% to 100%*".

If you would like to know how your machine and press output can be stepped up, send for a copy of "Tool Steel Simplified". It tells *how* to select the best tool steel for each job, and *how* to heat treat it for best results. Today, we all need as much helpful information as we can get. Let this handbook answer many of the questions that come up in your plant. "Tool Steel Simplified" is available at cost to tool steel users in the U.S.A.—$1.00 ($3.50 elsewhere). After you have read it, you will want more men in your plant to have copies.

Dept. 109, Reading, Pennsylvania

TIMELY TIPS

Conserving vital tool steels is an important part of the job of increasing War production. Here is another "Timely Tip" from the notebooks of Carpenter Servicemen. It is a little thing to remember today to get the most out of every pound of tool steel.

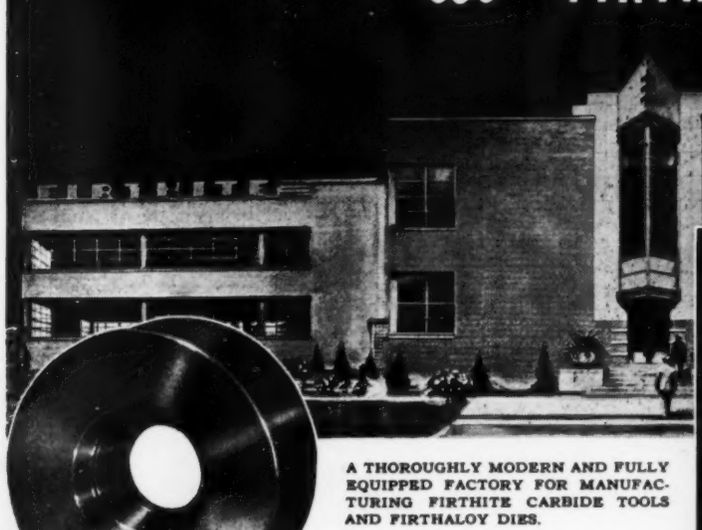
"Do not allow hardened tools to stand around for long periods of time before they are drawn. Hardened tools normally contain very high quenching stresses—in some cases enough to cause the tool to explode. Promptness in relieving these stresses is therefore very important. If tools can not be drawn immediately after hardening, a good place to 'store' them for a short period of time is in a warm bath of quenching oil."

If you would like extra copies of this "Timely Tip", we shall be glad to send them. And if at any time you have a specific tool steel problem, get in touch with your nearby Carpenter representative.

THE CARPENTER STEEL CO
Reading, Pa.

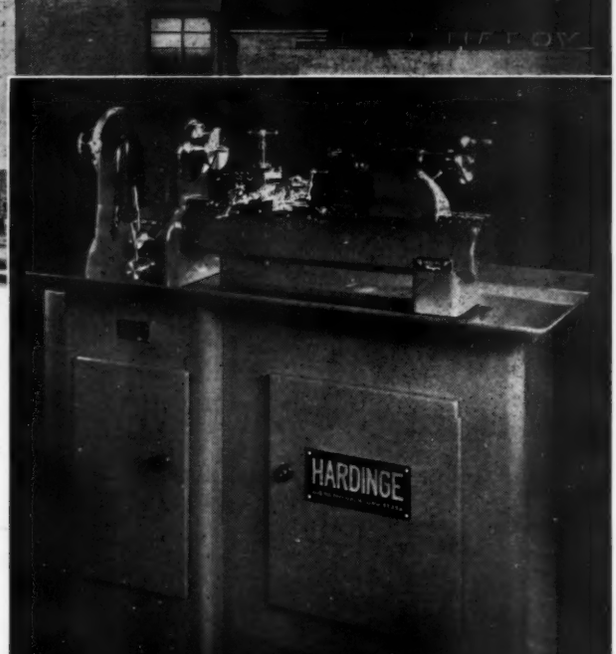
MATCHED TOOL STEELS

HARDINGE *Precision Lathes* *at* FIRTH-STERLING STEEL CO.



A THOROUGHLY MODERN AND FULLY EQUIPPED FACTORY FOR MANUFACTURING FIRTHITE CARBIDE TOOLS AND FIRTHALOY DIES.

TYPICAL WIRE-DRAWING DIE



THE MODERN HARDINGE HIGH SPEED PRECISION LATHE

AN INTERESTING COMMENT:

"In the manufacture of Firthaloy tungsten carbide dies, we have found the HARDINGE High Speed TR59 Precision Preloaded Ball Bearing Lathe to be indispensable for maintaining consistent accuracy."

"The Units in our Firthaloy die shop are capable of working to the extremely rigid tolerances we must adhere to when making dies and, also, gages to check the dies."

"The combination of high speed and accuracy in these machines, together with the feature of rapid change through a variety of speeds, has made it possible for us to supply uniform dies in quicker time."

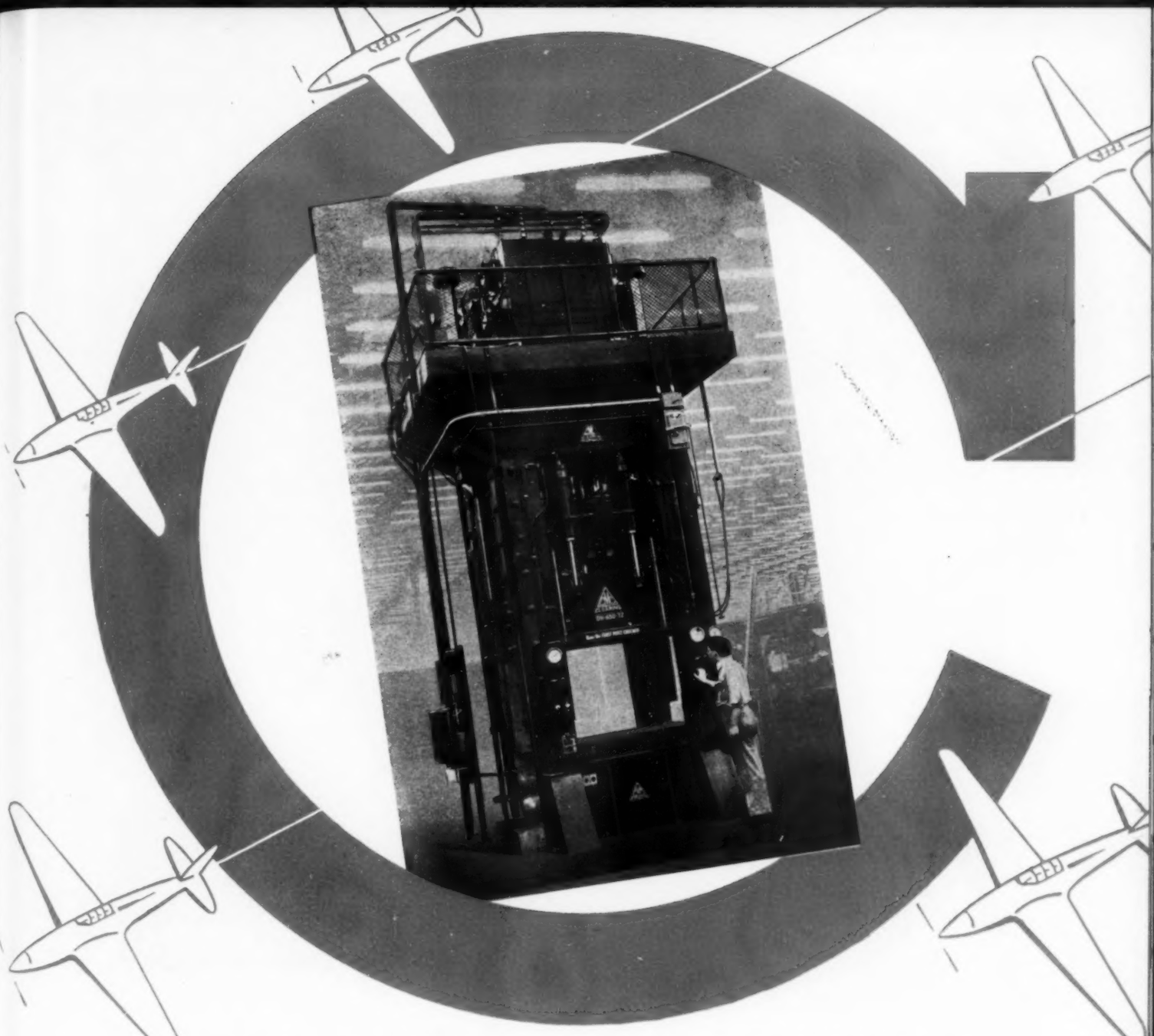
The above comment was forwarded to us by the Firth-Sterling Steel Company, McKeesport, Pennsylvania.

HARDINGE Precision Lathes are also used by Firth-Sterling sub-stations throughout U. S. for reworking wire drawing dies.

Hardinge Precision Lathes for Production, Tool-room and Laboratory Departments

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



CLEARING CRAFTSMEN

PROVIDE THE TOOLS FOR

Men of Air Craft

Wing sections, cowling, spars and panels, gas tanks and thousands of other sheet aluminum parts, present serious manufacturing and production problems to the aircraft men.

Applying to these problems Clearing's own modern press design and technique, Clearing Engineers have contributed important developments in mechanical and hydraulic presses for forming and drawing these parts efficiently with high production rates.

Press illustrated is a 600 Ton Double Action All Purpose Press.

Clearing Machine Corporation
6499 West 65th Street **Chicago, Illinois**

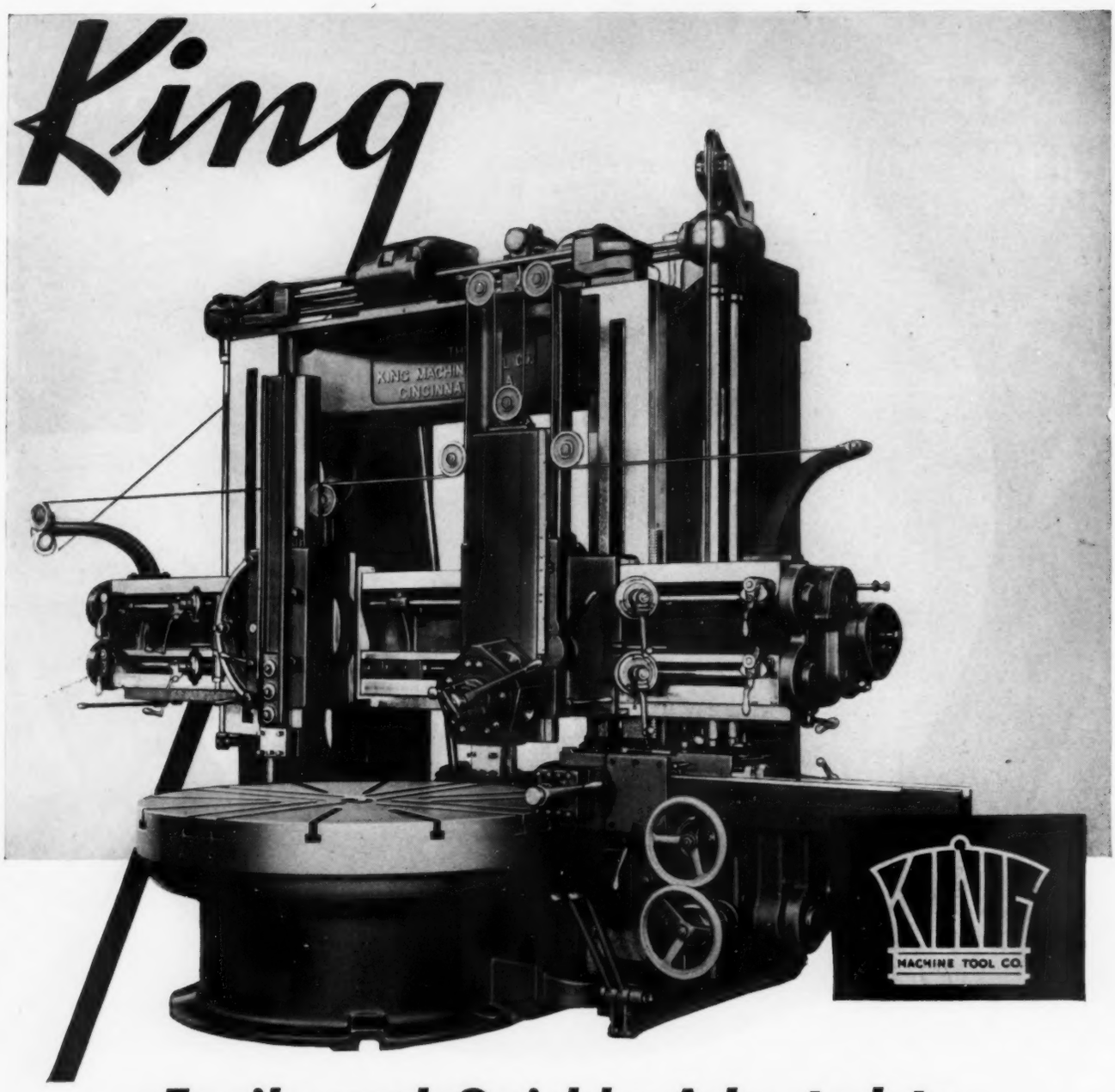
MECHANICAL AND HYDRAULIC PRESSES

CLEARING

MACHINE CORPORATION

CHICAGO

King



Easily and Quickly Adapted to Exclusive War Jobs

Designed and built to withstand high speeds and heavy feeds in both iron and steel castings—powered and constructed for high speed cutting tools —capable of maintaining 24 hour work schedules over long periods—the King Vertical Boring & Turning Machine is easily and quickly adapted to War work.

Evidence of its wide adaptability is found in its sixteen mechanical speed changes—twelve feeds—power rapid traverse to each head including side head — automatic lubrication to complete drive, table and spindle from reservoir in base.

Built in single column types from 30" to 42"—double column up to 10 feet is ideal for tank and heavy equipment jobs required for our armed forces.

The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

RUGGED AND *FAST!*

★

THE FAMOUS

MAXIMILLER

for PRODUCTION NOW!

★

OUTSTANDING IN THE 54-YEAR HISTORY OF

KEMPSMITH

MILLING MACHINE

KEMPSMITH MAXIMILLER

for PRODUCTION *Now* AND IN THE FUTURE

MAXIMILLERS have what it takes for the great battle of PRODUCTION NOW for your VICTORY OFFENSIVE. Because MAXIMILLERS save that surplus of hardness needed for heavier cuts; free from dangerous deflection or vibration; increased range of speeds and feeds; more power; longer accuracy; easier operation; centralized controls and many other KEMPSMITH advantages. Sizes No. 3 to 5 Vertical and Horizontal Plain or Universal.

TO SPEED PRODUCTION ECONOMICALLY ON

PRECISION

MILLING MACHINERY

Experience SINCE 1888

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN

IN PLANTS CONVERTED TO WAR WORK

Do Your Motors Match The Job?

New work for machines means new loads on motors. Make this MOTOR FITNESS TEST a basic point in your conversion program. It will help you to get the most out of each machine—to achieve peak output sooner, and to forestall future shutdowns.

General Electric Co.
Sect. 750-140A, Schenectady, N. Y.
Yes, send me the Motor Fitness Manual, GEA-3873.

NAME .....

TITLE .....

COMPANY .....

ADDRESS ..... STATE .....

CITY .....

Motor Fitness Manual

for plants converting or already converted, to war production. Tells what to do to get the most out of motors, old or new. If you're undertaking new work on motor-equipped machines, if you're "switching" motors from one job to another, or equipping machines with new motors—you'll find here helpful facts to save your time. Write for a copy.

MAKE THIS

MOTOR FITNESS TEST

1 WHEN YOU SHIFT a machine to war work, even if there is no real change in the type of work the machine will be doing—

☐*Check motor conditions.* Examine bearings, insulation, wiring connections. Clean the motor thoroughly inside and out.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

2 IF YOU RELOCATE the machine, or change other machines nearby—

☐*Check power supply.*

☐*Check on physical protection of the motor.* If an open motor, particularly one of older design, make sure it is safeguarded against entry of chips, cast-iron dust, excessive coolant.

☐*Recheck alignment and mounting arrangement* to prevent vibration and rapid bearing wear.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

3 WHEN YOU BEGIN the first trial run on new work—

☐*Measure voltage and determine ampere value* under load with a hook-on volt-ammeter or other load-analyzing instrument.

☐*Check motor starting characteristics,* making sure that the motor comes up to speed promptly.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

4 AS YOU PLAN new operating schedules—

☐*Review the motor lubrication and maintenance routine* to be sure it will receive regular attention at intervals in keeping with the new duties.

THE G-E MOTOR FITNESS MANUAL TELLS HOW

5 SHOULD YOU FIND motors now in service inadequate for the job—

☐*Get in touch with your local G-E motor representative,* who will advise you as to whether they should be repaired, rebuilt, or replaced. *Don't wait for motor trouble which may delay production before taking this step.*

AND REMEMBER—If new motors are required to meet present-day conditions, G-E Tri-Clad motors in standard, open construction (1 to 100 hp) are generally available without delay for high-priority war jobs.

The Navy "E" for Excellence has been awarded to 92,700 G-E Electric employees in five manufacturing naval equip

BUILDER OF TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

GENERAL ELECTRIC

NEW ENGLAND GRINDING MACHINE BUILDER PREVENTS "BOTTLE-NECKS" WITH CLEVELAND *Single Spindle* AUTOMATICS

LET'S GO! U.S.A. KEEP 'EM FLYING!

Bulletin (6 pages) describing 3¾-inch Model A

Bulletin (8 pages) describing 1 1/16-inch to 2½-inch Model B

Bulletin (6 pages) describing 5¾-inch Model A

Bulletin (4 pages) describing 1 1/16-inch Model A

• A large grinding machine builder in New England recently installed a battery of Cleveland *Single Spindle* Automatics in his production line to speed up building of his own machines, at present mostly absorbed by the aircraft industry. Results of this installation have been gratifying and note-worthy. "Bottle-necks" have been broken, production pyramided, costs cut down rapidly. Aircraft plants are getting precision grinding machines a little faster than was possible before because of the efficiency and flexibility of these Cleveland Automatics.

Here is one of three 3¾-inch capacity Clevelands in use in this plant. When this machine was photographed the disaster of Pearl Harbor was 60 days in the future, but no time was being lost in production of vital machines for aircraft builders even then.

The open control panel shows the heart of the compact, modern electrical system which is standard equipment on Cleveland Model A machines built with 4-speed motor drive in 3¾-inch to 8-inch capacity, with universal camming and variable tool feed. In 1 1/16-inch to 2½-inch sizes constant speed drive is standard, but two-speed drive is optional at slight extra cost.

Small lots and short runs require quick tool changes and ready accessibility—and Clevelands have always had those advantages available to the operator. Rugged construction and design contribute to the fine accuracy possible with these modern machines, and carefully engineered design features insure the permanence of the inherent accuracy. Descriptive bulletins on the size you can use in your production are ready to send you.

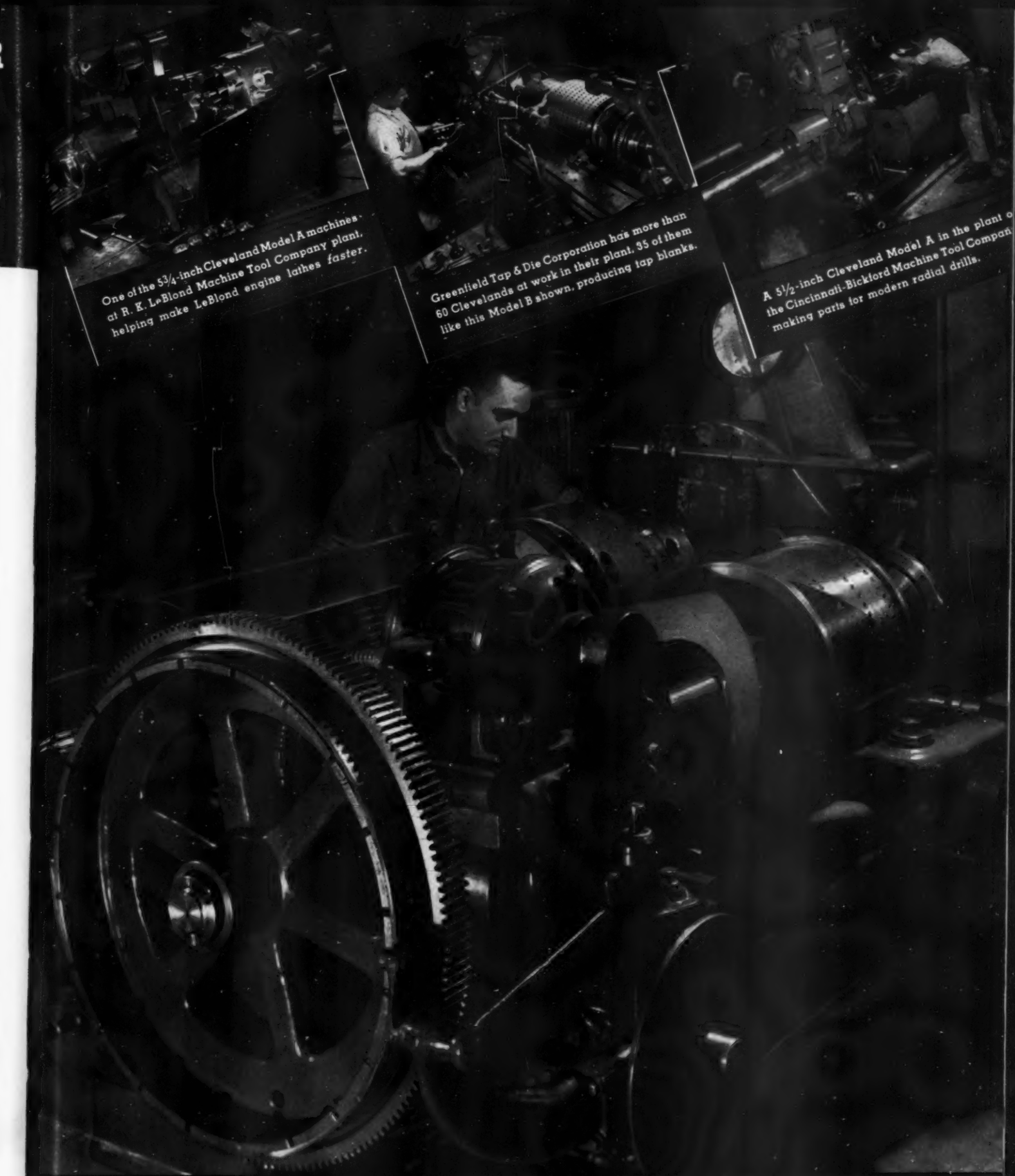
THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 ASHLAND ROAD · CLEVELAND, OHIO

Sales Offices: CHICAGO: 565 W. Washington Street • DETROIT: 540 New Center Building
NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**



One of the 5 3/4-inch Cleveland Model A machines at R. K. LeBlond Machine Tool Company plant, helping make LeBlond engine lathes *faster*.

Greenfield Tap & Die Corporation has more than 60 Clevelands at work in their plant. 35 of them like this Model B shown, producing tap blanks.

A 5 1/2-inch Cleveland Model A in the plant o the Cincinnati-Bickford Machine Tool Compan making parts for modern radial drills.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL B—Built in 9/16-inch to 2 1/2-inch capacities inclusive

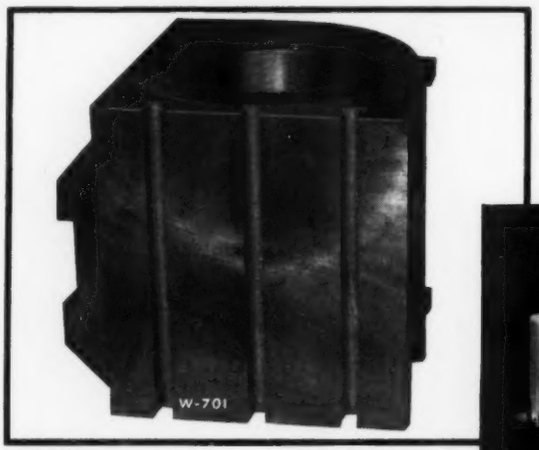
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- **Adaptability**
- **Fixture Saving**
- ★ **Operation Saving**
- ★ **Material Saving**
- **Fine Finish**
- ★ **Flatness**
- ★ **Close Limits**

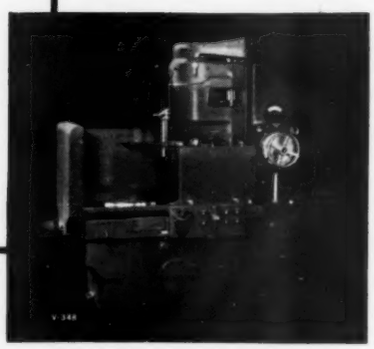
★ . . . . . ***Especially valuable on jobs like the one illustrated.***

"PUT IT ON THE BLANCHARD"



Semi-Steel
Stock per side 1/8"
Limits ±.005"
square .001"
to .0015" in 16"

No. Sides 6
1 piece (6
surfaces)
1 hour and
35 min.



THE SHAPER TABLE, 15½" x 16" x 16", illustrated here, is an excellent example of large, heavy work which may be ground with ease on a Blanchard No. 18 Surface Grinder with 6-inch extended column. These tables come to the Blanchard as rough, semi-steel castings. Six sides are ground, 1/8" stock being taken off each side.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

THREADS

of exceptional finish to close tolerances at high productive rate

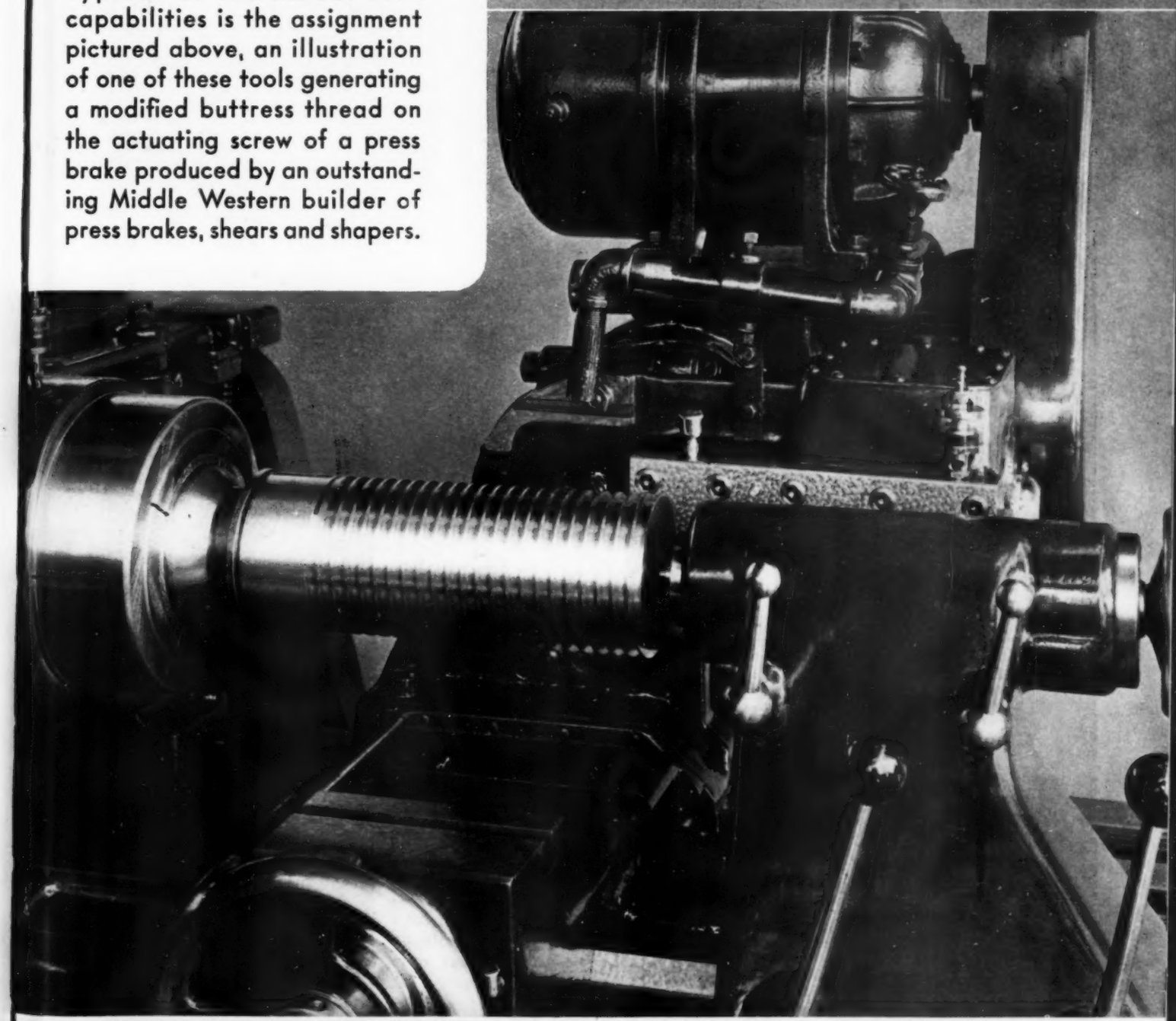
• • •

LEES-BRADNER

HT THREAD MILLER

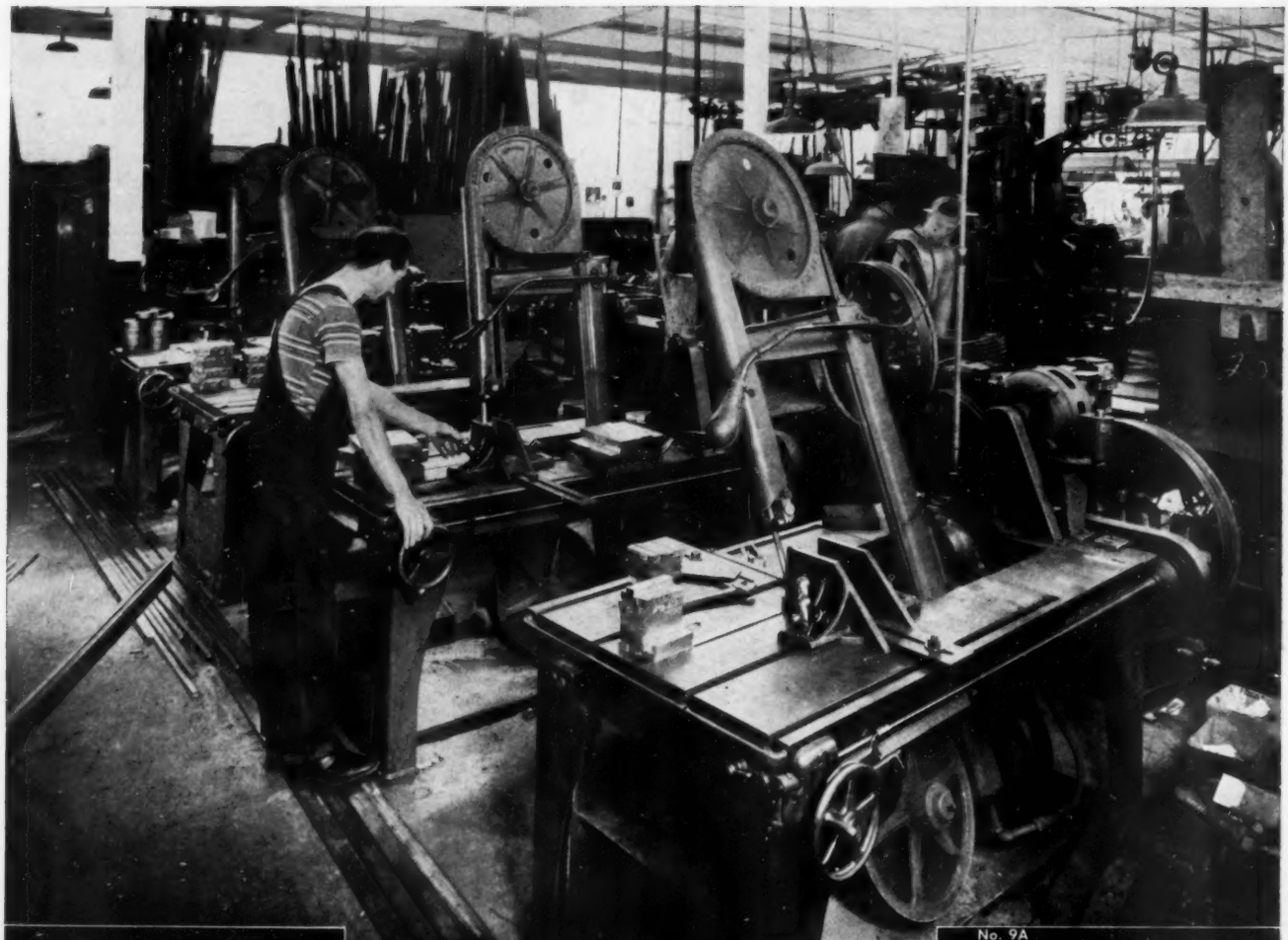
● The inherent ruggedness, a characteristic of Lees-Bradner engineering, of the Model HT Heavy thread Miller, permits the use of feeds and speeds greatly in excess of previous practice.

Typical of the Model HT's capabilities is the assignment pictured above, an illustration of one of these tools generating a modified buttress thread on the actuating screw of a press brake produced by an outstanding Middle Western builder of press brakes, shears and shapers.



The LEES-BRADNER Company

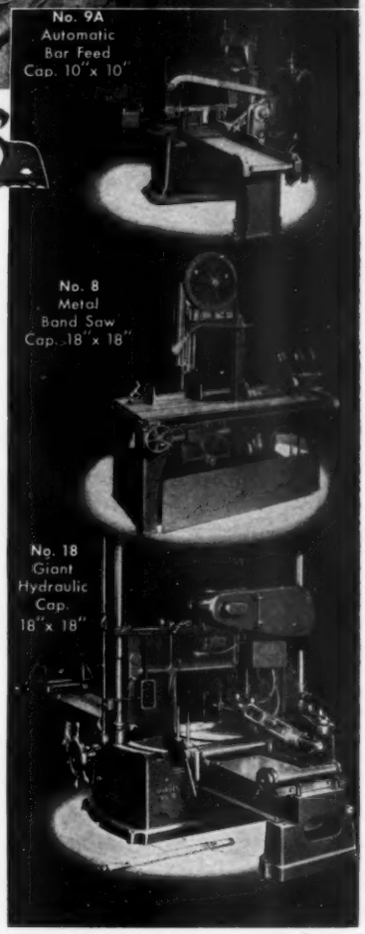
CLEVELAND, OHIO, U.S.A.



MARVEL SAWS

Accurate, Fast, Dependable and each cutting at a different angle

One of the universal features of MARVEL No. 8 Metal-cutting Band Saws is well illustrated in the above picture taken at the Gorham Tool Company, Detroit. Here a battery of 4 MARVEL No. 8's attended by a single operator, are all busily cutting-off tool bits from nested high speed steel shapes, *and each is cutting at a different angle.* These MARVEL No. 8's are also used by this firm for cutting-off blanks for side and end mills, and for cutting out crank shaft tools, form tools and dovetails. Handling work to 18" x 18" cross section, almost any type cut, these universal tools have proven "very economical on splitting operations, accurate, fast and dependable."



ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York

MULT-AU-MATIC OPERATORS ARE SAFE!

See that loading spindle right in the center of the picture? There are no cutting tools, no lubricant, no whirling work or chuck jaws to catch the clothes—nothing to confuse or interfere with rapid, safe handling of work.

There is never any movement at this station, and it is the only one which the operator needs to approach while the Mult-Au-Matic is in motion.

Sometimes rapid, automatic machines are difficult to operate—even dangerous to a tired operator. But not Mult-Au-Matics. Their speed and accuracy are not obtained at the sacrifice of safety. They are safe in the early morning—and equally safe at the end of the shift.

BULLARD

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Bardons and Oliver

Built to Meet 1942 PRODUCTION DEMANDS!

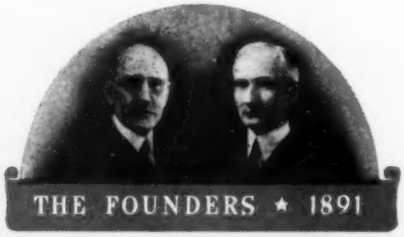
FAST? The Bardons & Oliver No. 3 Universal Turret Lathe is extremely easy to operate. All control levers can be manipulated conveniently from one control point.

PRODUCTIVE? The powerful drive, together with the sturdy construction makes it easy to take several cuts simultaneously.

FLEXIBLE? The machine is exceptionally well adapted to a large range of variety of bar, chucking, or second operation work.

ACCURATE? Because of the close work tolerances that can be held, this machine is a favorite for work on Airplane parts.

NO. 3 UNIVERSAL TURRET LATHE

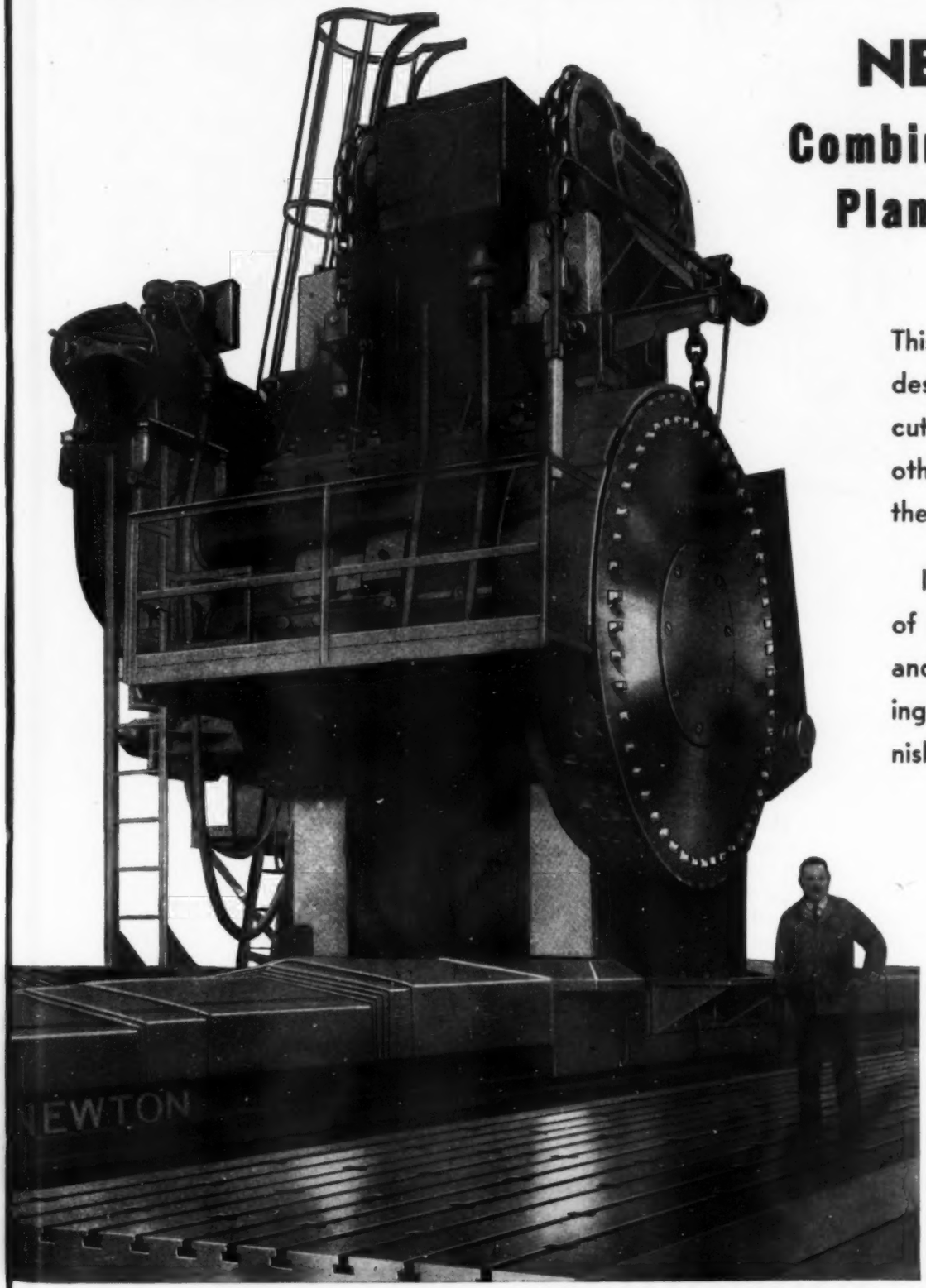


THE FOUNDERS ★ 1891

BARDONS & OLIVER, INC.

1155 W. 9TH ST. · · CLEVELAND, OHIO

MAMMOTH ROTARY PLANER SPEEDS BUILDING OF SHIPS



NEWTON

Combination Rotary Planer and Saw

This huge machine tool is designed for planing and cutting Armor plate and other tough metals used in the shipbuilding program.

It is the largest machine of this kind ever designed and is one of a number being built for the plants furnishing Armor plate.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

New, Quick Change-over OF TIMING CONTROL

KEEPS RESISTANCE WELDERS IN ACTION!

With the new Westinghouse Electronic Weld Timer you can change complete timing panel for any of 18 different resistance weld operations —in less than three minutes!

The entire timing panel, for example, is released by a single thumb screw. It has an exclusive swing-out design, with special "hingeless-hinge" and snap-hook chains for easy removal and replacement. All connections to the main transformer panel are made by plug and receptacle. No special wiring is needed.

Cabinet for all controls is standard, but timing panels are available in 18 NEMA types as either:

Automatic Weld Timers — to control timing weld current and electrode operation where synchronous control is not required.

or *Sequence Timers* — to control only sequence of electrode operation where duration of weld current is adjusted by Synchronous Control.

Today's welding production calls for action. Write for Bulletin 3079. It tells you how to increase the adaptability of your resistance welders. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania, Department 7-N.

J-21190

PLUG-IN TYPE RELAYS
...replaced in 10 seconds!

A typical example of how the new Westinghouse design speeds maintenance is the special type of plug-in relays. All wiring work is eliminated. Just pull out the old relay, insert a new one—and you're ready to go! Color coded relay base and sockets make identification quick and positive.

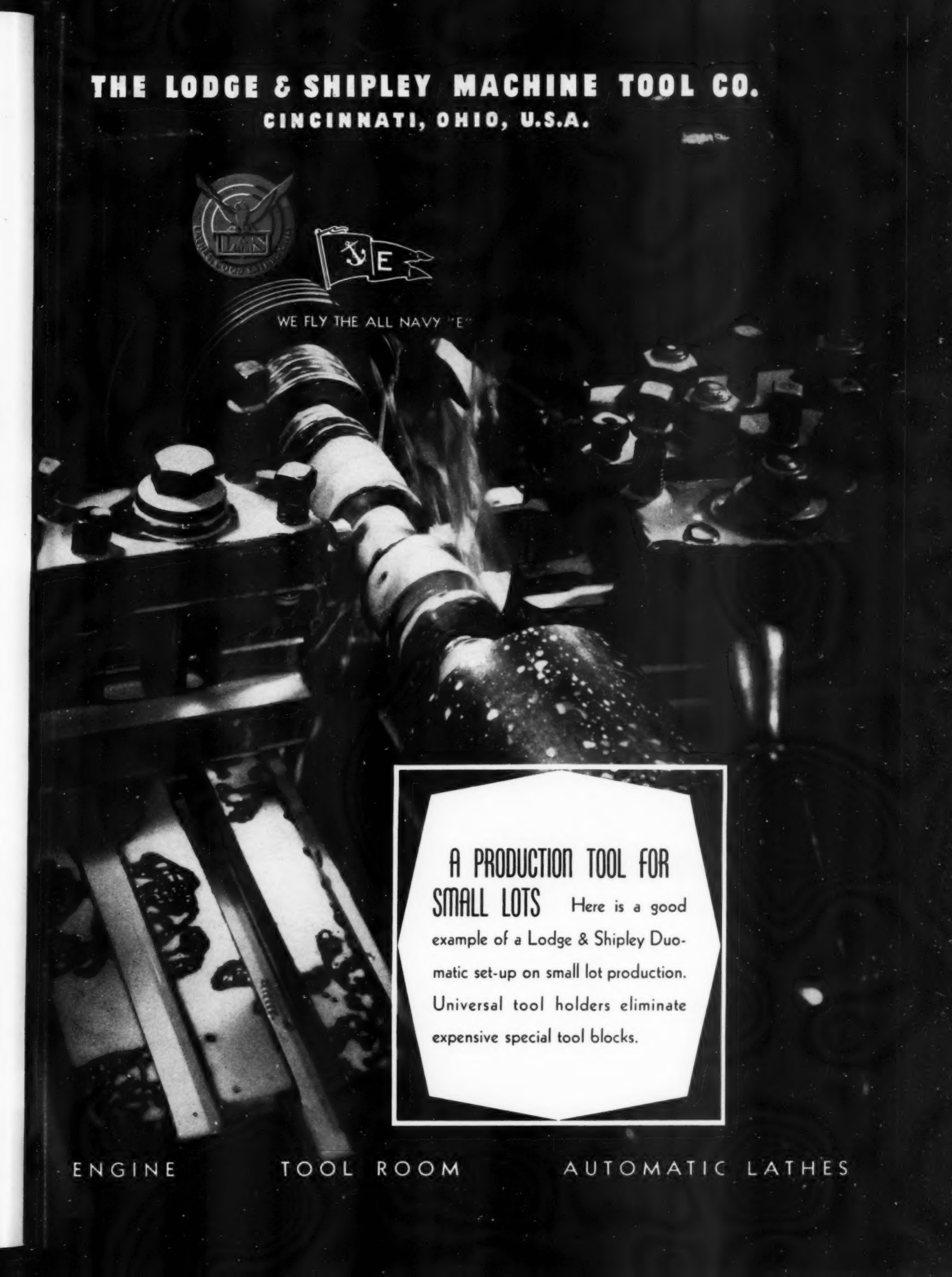
Westinghouse

RESISTANCE WELDING CONTROL

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A.

WE FLY THE ALL NAVY "E"



A PRODUCTION TOOL FOR SMALL LOTS

Here is a good example of a Lodge & Shipley Duomatic set-up on small lot production. Universal tool holders eliminate expensive special tool blocks.

ENGINE TOOL ROOM AUTOMATIC LATHES

REED-PRENTICE

NEW

No. 4
VERTICAL MILLER

New in design, new in performance the Reed-Prentice No. 4 Vertical Miller is built to meet the demands of today's most exacting requirements. Waste motion is eliminated. Centralized controls operate every movement of table and head, and stops can be set to control travel in all directions.

GENERAL SPECIFICATIONS

TABLE:	Working surface	24" x 70"
RANGE:	Longitudinal travel of table . . (Can be furnished 60")	48"
	Cross travel of ram	24"
	Vertical travel of head	12"
	End of spindle to table —	Max. 24", Min. 12"
	Throat depth	33"
	Top of table to under-side of ram ways	19¾"
MISC:	Net weight	20,150 lbs.

Fluid hydraulic motor driven screw insures smooth positive drive to table and cross slide with automatic acceleration and deceleration when rapid traverse motion is used.

Table ways are effectively guarded.

REED-PRENTICE CORPORATION

CENTRALIZED CONTROLS

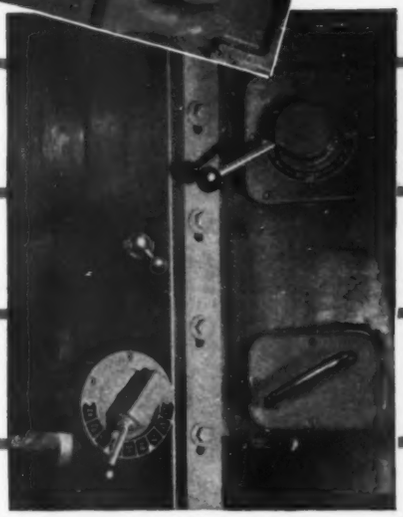
All controls are within easy reach of operator. Push button station controls operation of head while dotted lines indicate positions for feed and rapid traverse control in either direction. Ammeter indicates spindle load.

Quick Setting of Spindle Head

Head is controlled by quick traverse motor operated by push button. When used in connection with multiple turret stop motor is automatically shut off before head contacts positive stop. Final adjustment is made by hand wheel at upper left. Entire operation is performed in 5 to 10 seconds.

Dual Length Reading Dials

Large dual micrometer dials accurately record in inches and thousandths of inches table and cross slide travel.



Single Lever Preselector Dial

Spindle speed is quickly selected through a direct reading preselector dial in combination with back gear lever.

TYPICAL MILLING OPERATION

Illustration shows the No. 4 Vertical Miller cutting at the rate of 20 cubic inches per minute from hard cast iron block.

WORCESTER, MASS. U. S. A.

75 WEST ST., NEW YORK CITY 1213 W. 3d St., CLEVELAND, OHIO

Surface Grinders

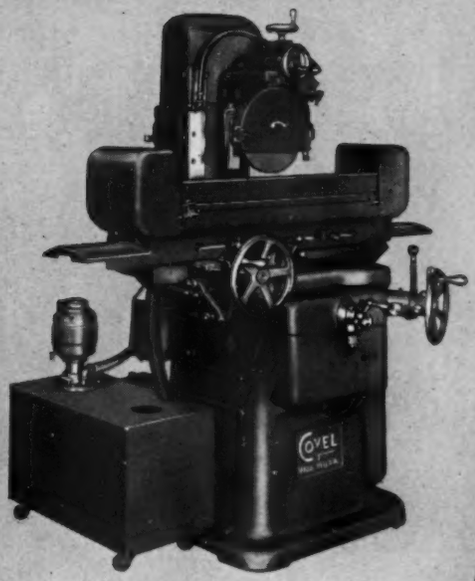
FOR YOUR "BATTLE LINE"

Frequent set-ups, or long runs — ultra-precision or accuracy at low cost — hand-feed or automatic — these are but a few of the factors which help determine the type of Surface Grinder best suited to your needs. But whatever your requirements are, you'll find them fulfilled in the Covel line of precision surface grinding machinery!

INDUSTRY'S BATTLE LINE
A typical scene, common to hundreds of factories where Covel Surface Grinders speed production "on the line" and in the toolroom. These are "Number Fifteens".

WHEN you choose Covel, you are selecting a Veteran—product of nearly seventy years' experience in the manufacture of precision machinery.

EARLY DELIVERIES TO WAR INDUSTRIES ★ ★ ★

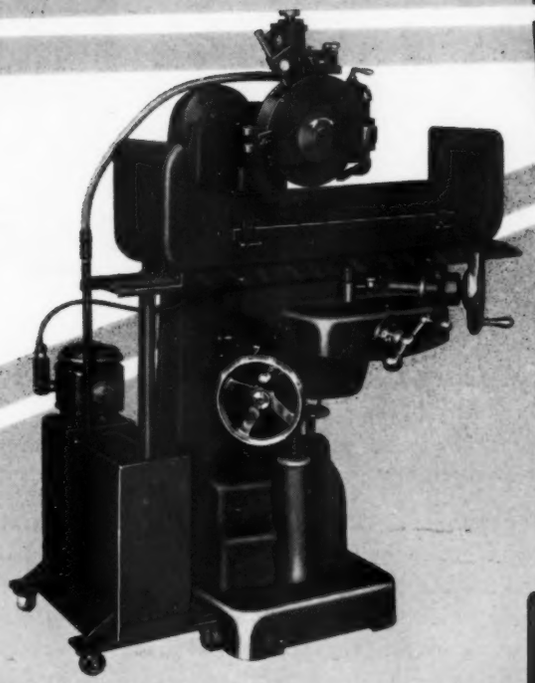


Covel No. 5 Precision Surface Grinder. Hydraulic Feed, shown equipped with wet grinding attachment. Capacity 8"x24".

Direct Hits!

COVEL SURFACE GRINDERS ARE SCORING HIGH IN WAR PRODUCTION TODAY . .

This is largely because Covel was prepared to meet the emergency with a complete line of up-to-the-minute precision grinding machinery designed and shop-tested in actual use before the nation's avalanche of war work



Covel No. 15 Hand Feed, 6"x18" capacity. Accuracy at low price.

Covel No. 20. A High Speed, Hydraulic Feed, Precision Surface Grinder. Capacity 6"x18".

Covel employees are working "all out" to "Keep 'Em Rolling" off the shipping platforms to you. Write, wire or phone about deliveries and nearest dealer.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

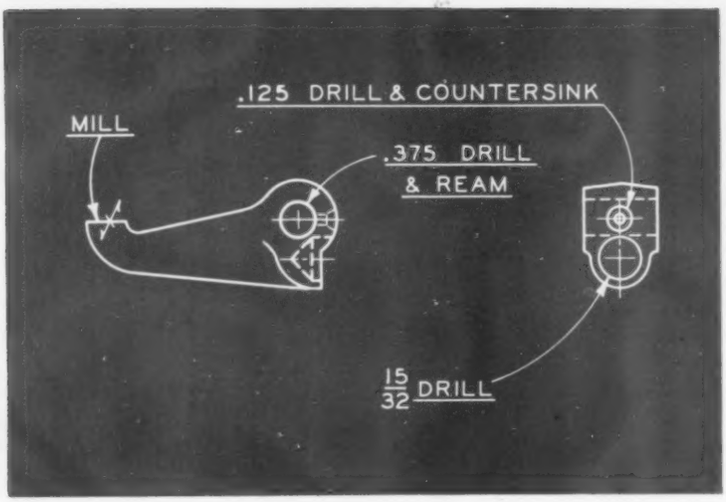
COVEL MFG. CO., BENTON HARBOR, MICH.

Automatic

transmission parts

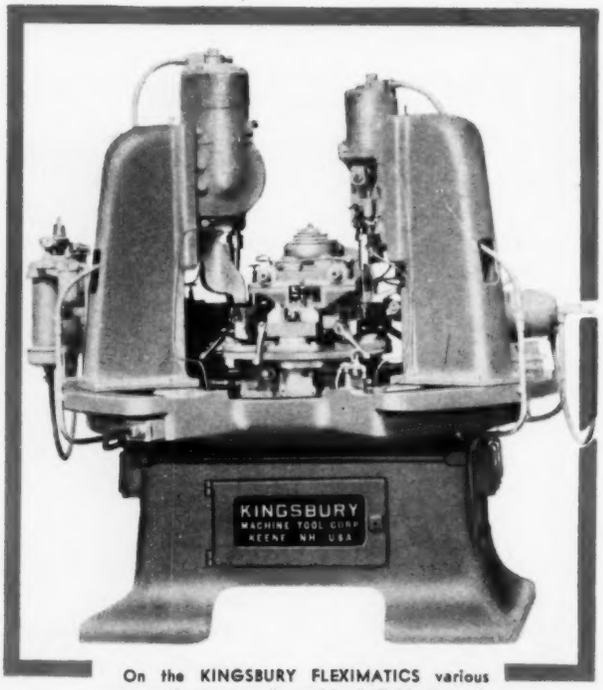
automatically

produced at top speed



FLEXIMATIC

by KINGSBURY



On the KINGSBURY FLEXIMATICS various operations are performed by individual standard units mounted on several types of sub-bases. Only a single chucking of the work is required regardless of the number of different operations involved. By this method of arranging standard automatic units, a unique combination of machining operations can be provided for as well as a flexibility in the machine for whatever change-overs may be necessary with a change in the nature of the work to be handled.

Drilling, reaming and milling forged steel levers for automatic transmissions are handled by this Model GD FLEXIMATIC in a single chucking of the work. Fixtures employed are hand operated, self-centering, two-jaw chucks.

The same principle of handling multiple operations which makes the FLEXIMATIC so highly productive on this job can be applied to other classes of work. That is why FLEXIMATICS are playing such a big part in today's all-out war program—turning out precision parts on a high production basis—performing drilling, reaming, tapping, counterboring, spot facing and other operations on intricate work and meeting the most rigid specifications.

All operations on FLEXIMATICS occur simultaneously. The time for one piece is the time for the longest single operation only—an advantage which not only means outstanding time savings but also savings in man-hours per piece. With FLEXIMATICS man power at machines is vastly more productive.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U. S. A.

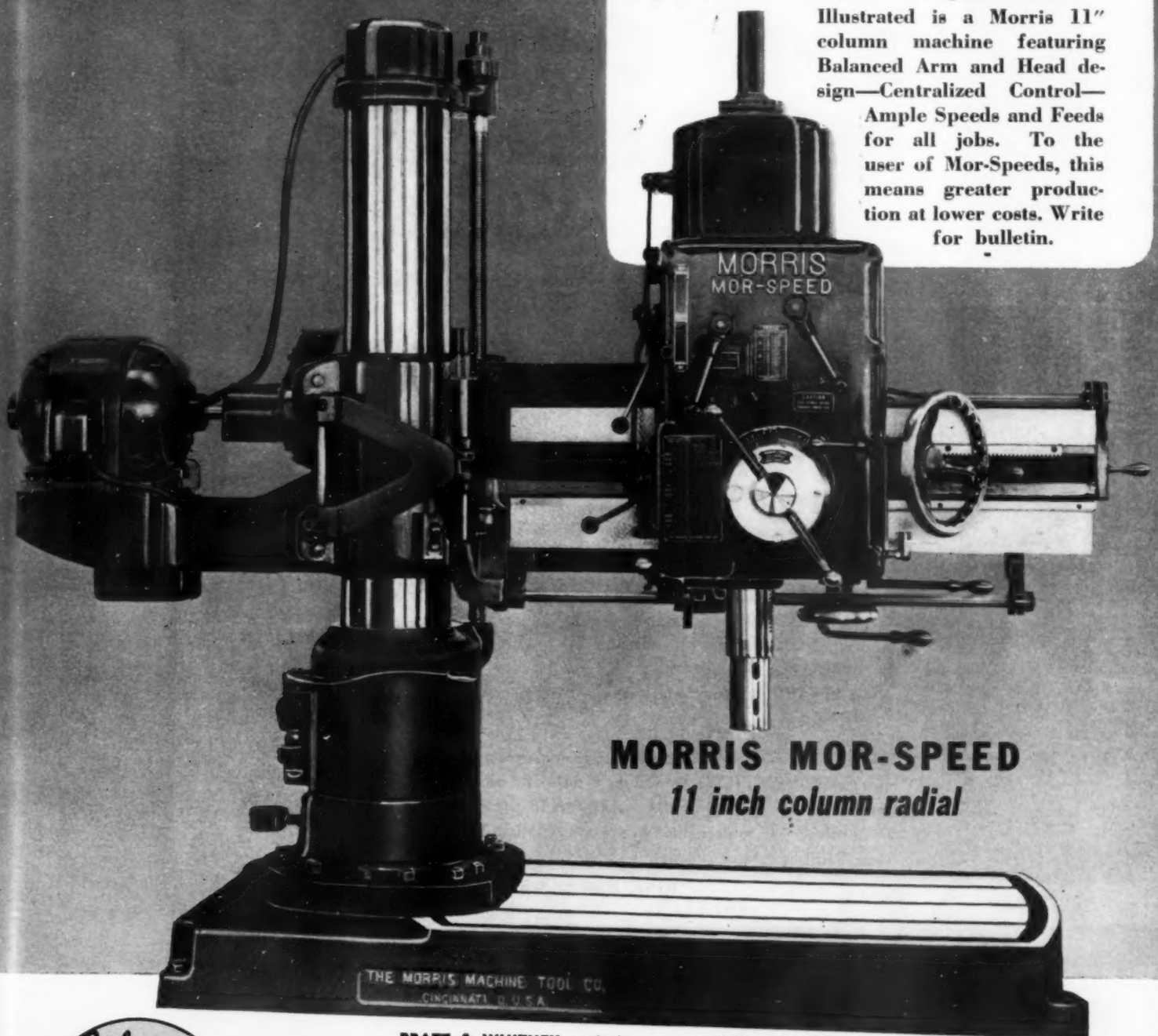
Concentrate your radial

OPERATIONS ON A MORRIS MOR-SPEED

● In a vast number of plants producing munitions, ships, tanks, and other war materials for all of our far flung fronts.—Morris Mor-Speed Radials are doing a major job.

Drilling—reaming—boring—facing and many other operations are being handled faster—at higher speeds—to closer tolerances—with greater ease on Morris Mor-Speed Radials.

Illustrated is a Morris 11" column machine featuring Balanced Arm and Head design—Centralized Control—Ample Speeds and Feeds for all jobs. To the user of Mor-Speeds, this means greater production at lower costs. Write for bulletin.



MORRIS MOR-SPEED
11 inch column radial

PRATT & WHITNEY exclusive representatives in U.S.A.

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.

CINCINNATI, OHIO

ANOTHER RUBBER SHORTAGE PROBLEM SOLVED

SAFETY ANNOUNCES A NEW CENTERLESS REGULATING WHEEL

MADE OF Saftoid

SAFETY Research Engineers after months of research and experimentation, have perfected a new revolutionary material SAFTOID, to take the place of rubber in Feed Wheels on Centerless Grinders. SAFTOID has undergone the most severe tests under the most severe plunge-cut and through-feed operations, in every case the new SAFETY wheels have proved to be more economical, have done a better job and lasted longer than ordinary rubber wheels.

7 POINTS OF SUPERIORITY
SAFTOID CENTERLESS REGULATING WHEELS

1. Less dressing is required.
2. SAFTOID eliminates chipping of edges.
3. SAFTOID holds its shape longer.
4. SAFTOID is more economical.
5. Wheels constructed of SAFTOID give 25 to 100% longer life.
6. SAFTOID Wheels cost less.
7. Eliminates worry about rubber shortage.

SAFETY is now in a position to prove the economy and dependability of the new SAFETY SAFTOID WHEELS. Practically all standard sizes are available for immediate shipment. We would like to show you how SAFETY engineers have solved one rubber shortage problem. Make tests in your own shop with the New SAFTOID Feed Wheel.

Write, Wire or Phone 4651

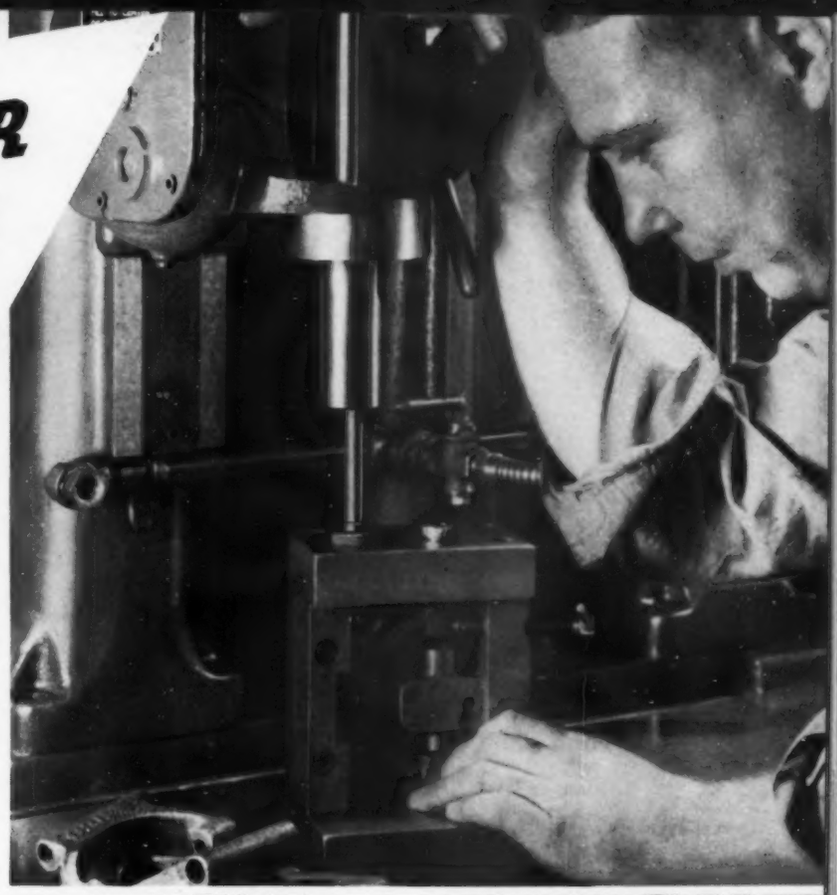
☆

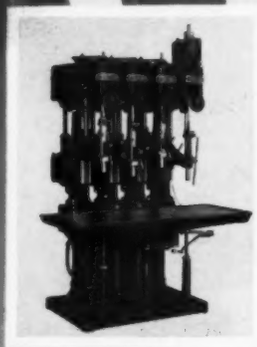
THE SAFETY GRINDING WHEEL & MACHINE COMPANY

SPRINGFIELD, OHIO

Sales Offices in Principal Cities

FASTER WAR PRODUCTION



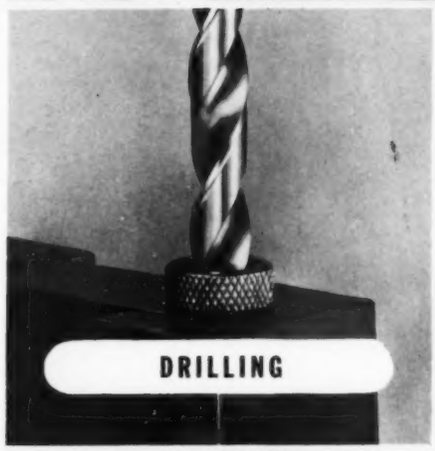


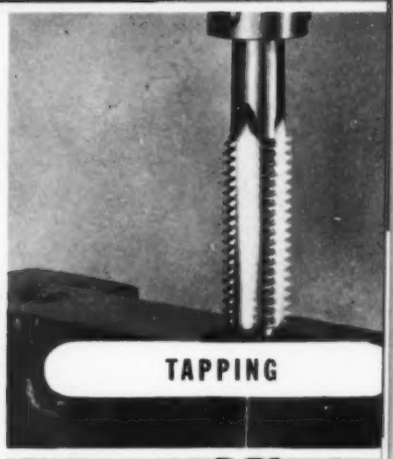
• Footburt Sensitive Drilling Machines help you meet those new production schedules needed to win the war. They are full range machines and are built in sizes to meet most small drilling requirements.

Spindle speeds from 185 RPM to 3450 RPM available on the No. 2 Machine. Made in 1, 2, 3, 4 and 6 spindle models. No. 3 machines have capacity up to 1¼″ in cast iron.

Power feed, back gear, built-in tapping and coolant furnish all the necessary attachments. Footburt Sensitives are rigidly built to drive cutting tools to their full capacity. Write for price and delivery information.

THE FOOTE-BURT COMPANY
CLEVELAND, OHIO
Detroit Office: 4-253 General Motors Building





FOOTBURT *Sensitive* DRILLING MACHINES

"That's why we call 'em 'Victory' lathes!"

Dear Frank,

Madison, Wisconsin

Remember how busy we thought we were last summer, before you left? Honestly, that was just a breeze compared with the way things are going now!

Guess we told you about those big turret lathes we're going to build in such large quantities. With a few modifications - - with a new production set-up - - and with the green light from Uncle Sam, we're going to turn them out 1500% faster than we've ever built these sizes! That'll put 'em where they're needed in a hurry! That's why we call 'em "Victory" lathes!

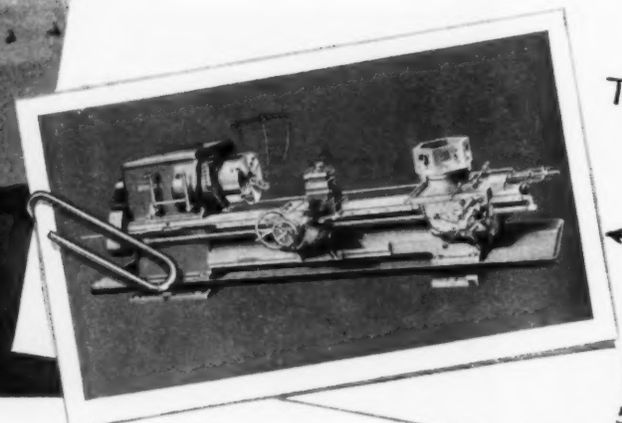
So you see, we're rolling, too, Frank! And we're going to keep it up just as fast and as long as we have to until the Axis hollers "'Nuff!"

That's the way we feel about it. So do the fellows who will operate these lathes. It's our fight as well as yours. So, if it's a war of machines they want, let's give it to them! They asked for it!

Keep 'em rolling, and we'll do the same!

Best regards,

The fellows at Gisholt



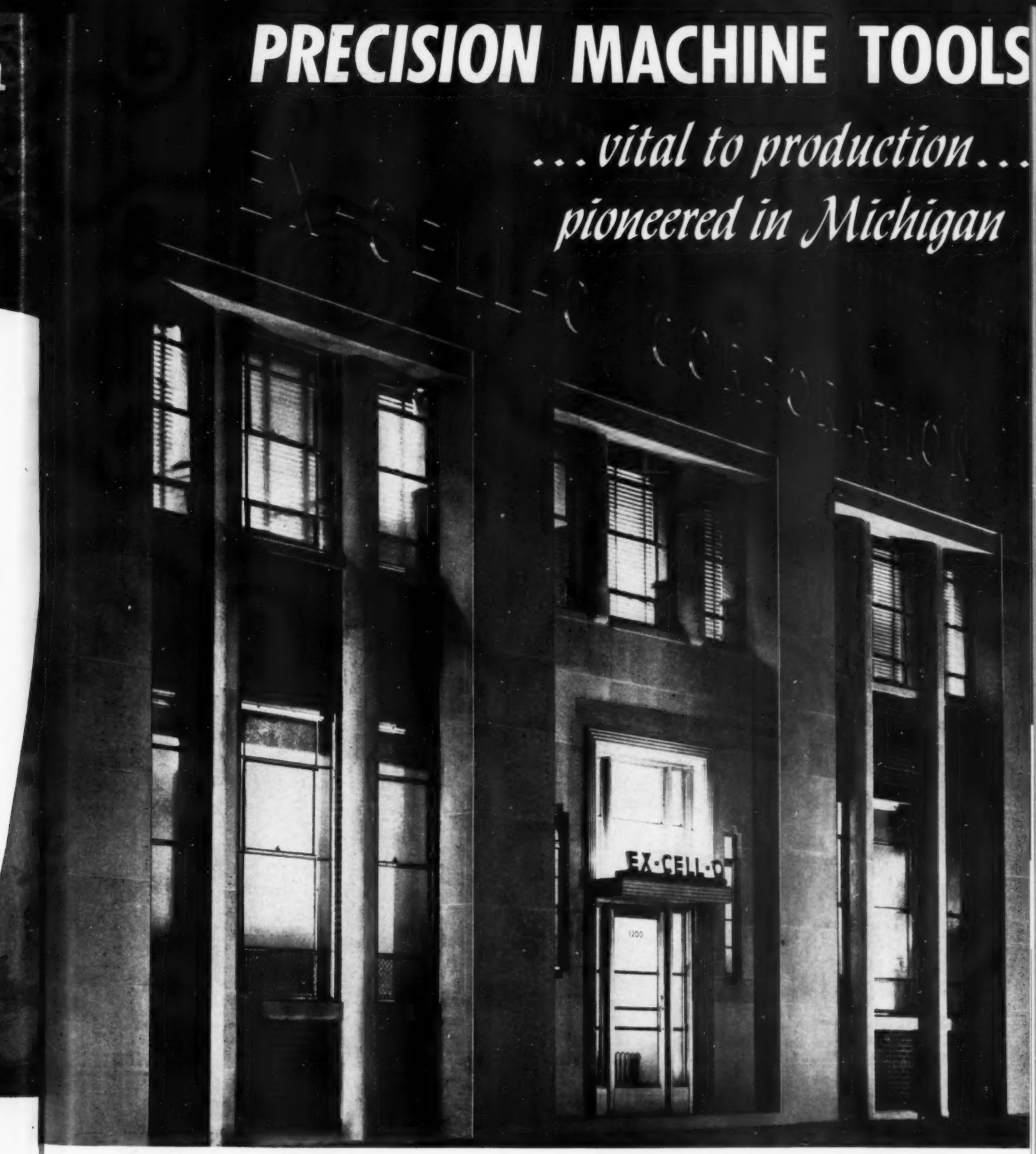
Here's how the new "Victory" models look. They're modified versions of the standard Gisholt Saddle Type Turret Lathes with 21" and 24" chucks 5¼" and 9¼" spindle bores

GISHOLT

Here's news as welcome on the production front as it is on the fighting front. Learn what Gisholt is doing to help solve a pressing problem for America's vital war industries today.

PRECISION MACHINE TOOLS

...vital to production...
pioneered in Michigan



FROM out of the doorway of Ex-Cell-O Corporation in Detroit . . . for practical use by American industry . . . have come, since 1919, many of the important developments in *precision* machining . . . developments now indispensable to manufacturing firms from coast to coast as they, like Ex-Cell-O, direct all their resources and efforts to the bringing of Victory to the United Nations!

EX-CELL-O CORPORATION • 1200 OAKMAN BOULEVARD • DETROIT

XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DIESEL FUEL INJECTION EQUIPMENT, R. R. PINS AND BUSHINGS, DRILL JIG BUSHINGS, PARTS

AS IMPORTANT AS THE FUSE IN YOUR POWER LINE--

SAFETY SLIDE IN THE FERRACUTE *Automatic* PIN CLUTCH

The Clutch Slide or Driving Dog on the Ferracute Automatic Pin Clutch is a specially engineered SAFETY DEVICE. Made of Alloy Steel, carefully heat treated, the Slide will give you years of service under normal conditions. It is designed, however, to break when the press is dangerously overloaded---thus preventing more serious damage to press, dies, or to operator.

The Safety Slide does the same job as the fuses in your power line---and is as easily replaced since it is round and can, in an emergency, be made in any machine shop. It is one more engineering feature that keeps FERRACUTE presses on the firing line without interruption.

The Ferracute Automatic Pin Clutch is a complete, compact unit of clutch and brake assembled together---an exclusive feature, found on no other press. It is standard equipment on all the small and medium sizes of the famous FERRACUTE PRESS line.

FERRACUTE MACHINE COMPANY
Bridgeton, New Jersey, U. S. A.

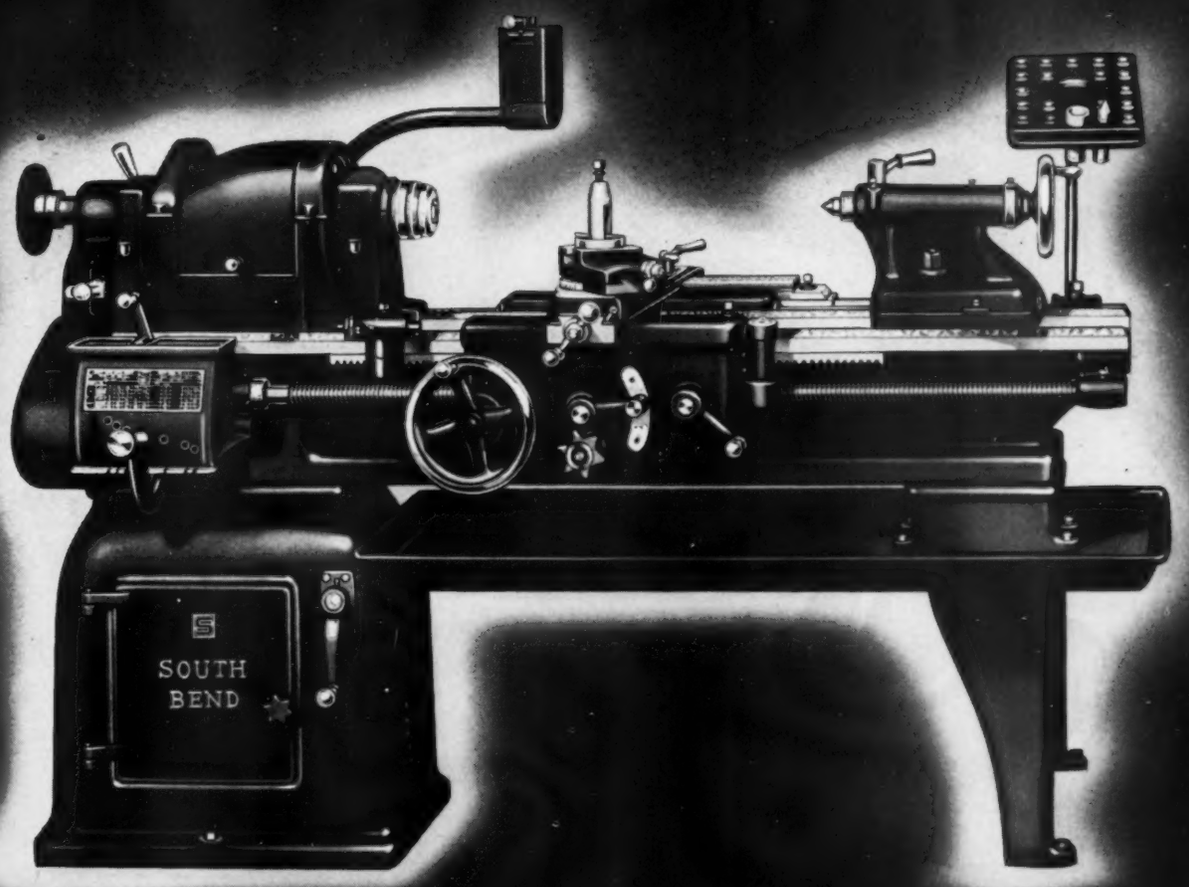
AS EASY TO REPLACE AS A FUSE

TRADE FERRACUTE MARK

PRESSES *and* PRESS BRAKES

VERSATILITY

to Speed Production



VERSATILITY which permits quick change-over from one job to another, with little inconvenience or loss of time, is a real speed-up factor in tooling a new job. Such versatility—the reduction of set-up time to a minimum—enables you to get into production quickly. It is one of the advantages in selecting South Bend Lathes for urgent defense contract work calling for early deliveries.

Permanent accuracy is built into South Bend Lathes to assure uniform precision. Their wide range of spindle speeds permits machining work with maximum cutting tool efficiency. And not the least important—their convenient controls make for an ease of operation which reduces fatigue and lessens the possibility of error.

Ideal for the heavy production schedules which National Defense demands, South Bend Lathes come in five sizes—9″, 10″, 13″, 14½″ and 16″ swing—all sizes supplied with toolroom or manufacturing equipment. Write for catalog and name of nearest dealer.

SOUTH BEND LATHE WORKS

Dept. 228 South Bend, Indiana, U. S. A.

LATHE BUILDERS FOR 35 YEARS

LET'S GO! U.S.A. KEEP 'EM FLYING!

STANDARD
Dial Bore Gages

"CONVOY YOUR PARTS THRU PRODUCTION"

STANDARD GAGE CO., INC.
POUGHKEEPSIE, NEW YORK

Thompson·

PATENT PENDING

"THOMPSON" with the 3 way circular swing

UNIVERSAL MILLING FIXTURE

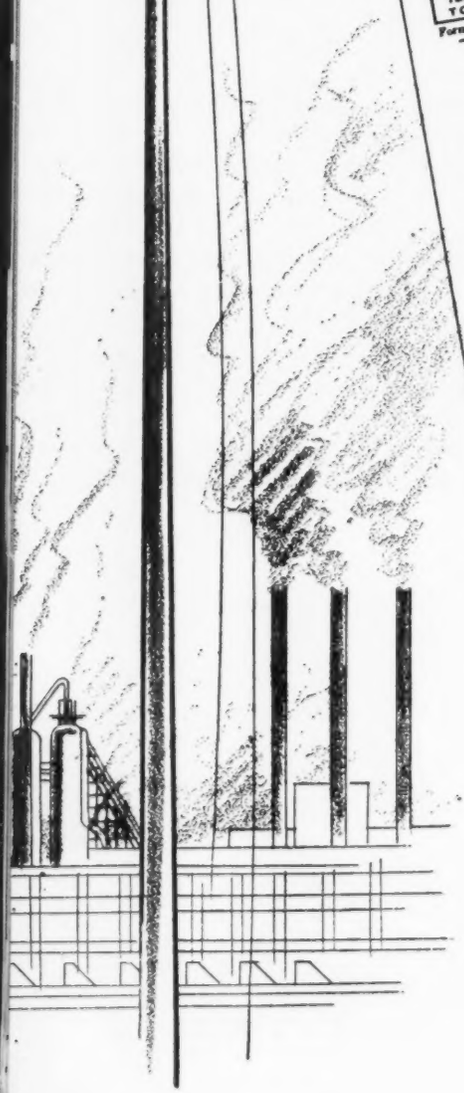
The Thompson Universal Milling Fixture has been designed specially for use on any standard bench lathe — convert any bench lathe, easily and quickly, into an economical, time-saving milling machine. Provides a wide variety of applications — vise and universal slide base can be used without index fixture for straight or angular milling — efficiently used for milling punches, end mills, key ways, C'bores or the manufacture of duplicate parts — practical, time-saving, economical, efficient, the "THOMPSON" is essential in the modern tool room or production department.

Index Fixture tilted at 30° milling end teeth in Taper Reamer.

Fixture and Base at right angles milling straight teeth in cutter.

Base of Fixture on 30° angle milling end teeth in cutter.

AUTO-ORDNANCE CORPORATION



STANDARD TIME INDICATED
RECEIVED AT
SPRINGFIELD
MASS.

TELEPHONE YOUR TELEGRAMS TO POSTAL TELEGRAPH

Form 16 L

Postal Telegraph

THIS IS A FULL RATE TELEGRAM, CABLEGRAM OR RADIOGRAM UNLESS OTHERWISE INDICATED BY SYMBOL IN THE PREAMBLE OR IN THE ADDRESS OF THE MESSAGE. SYMBOLS DESIGNATING SERVICE SELECTED ARE OUTLINED IN THE COMPANY'S TARIFFS ON HAND AT EACH OFFICE AND ON FILE WITH REGULATORY AUTHORITIES.

WE334 GOVT PD TWS 3 MINS WAR WASHINGTON DC JUNE 10

TO THE MANAGEMENT AND EMPLOYEES OF THE
BAUSH MACHINE TOOL COMPANY
SPRINGFIELD MASS.

THE ARMY AND NAVY ARE PROUD TO INFORM YOU THAT THE ARMY AND NAVY STAR IS TO BE AWARDED TO YOU IN RECOGNITION OF YOUR FINE WAR PRODUCTION RECORD. YOUR TOOLS HAVE AIDED IN THE PRODUCTION OF THE PLANES, TANKS, GUNS AND SHIPS WITH WHICH OUR FIGHTING FORCES ARE CARRYING ON. THE ARMY AND NAVY ARE LOOKING TO YOU AS SOLDIERS OF PRODUCTION FOR THE ESSENTIAL TOOLS AND THE ESSENTIAL WEAPONS. WE KNOW YOU WILL CONTINUE TO RESPOND AND NOT ONLY KEEP UP BUT IMPROVE YOUR PRESENT FINE RECORD. OUR CONGRATULATIONS.

PATTERSON - UNDER SECRETARY OF WAR
FORRESTAL - UNDER SECRETARY OF THE NAVY

For more than fifty years when a national emergency has arisen, the Baush Machine Tool Company has tried to be helpful. We furnished equipment used in winning the Spanish-American War, World War I and are helping in World War II.

With a feeling of profound obligation we of the Baush Machine Tool Company accept the Army and Navy Star not so much for what we have done but as a symbol and pledge for what we will try to do from this day on.

June 20th, 1942.

BAUSH MACHINE TOOL COMPANY

BAUSH *Lead Screw* PRECISION TAPPING MACHINE

ALL HOLES TAPPED WITHOUT MOVING WORK

By way of example the action photograph above, taken in a large aircraft plant shows the Baush Lead Screw Precision Tapping Machine applied to the tapping of holes on a production job.

This machine was designed at suggestion of aircraft manufacturers to do away with finish hand tapping.

Automatic counting device governing depth of travel and number of threads does away with operating errors.

Arm running 30 inches and swinging 360 degrees on ball bearings gives accuracy, speed and ease of operation.

No. 3 tap (American Standard—British No. 2) obtained in one tapping cycle.

Tapping spindle and lead screw assembly are easily and quickly changed to different tap sizes.

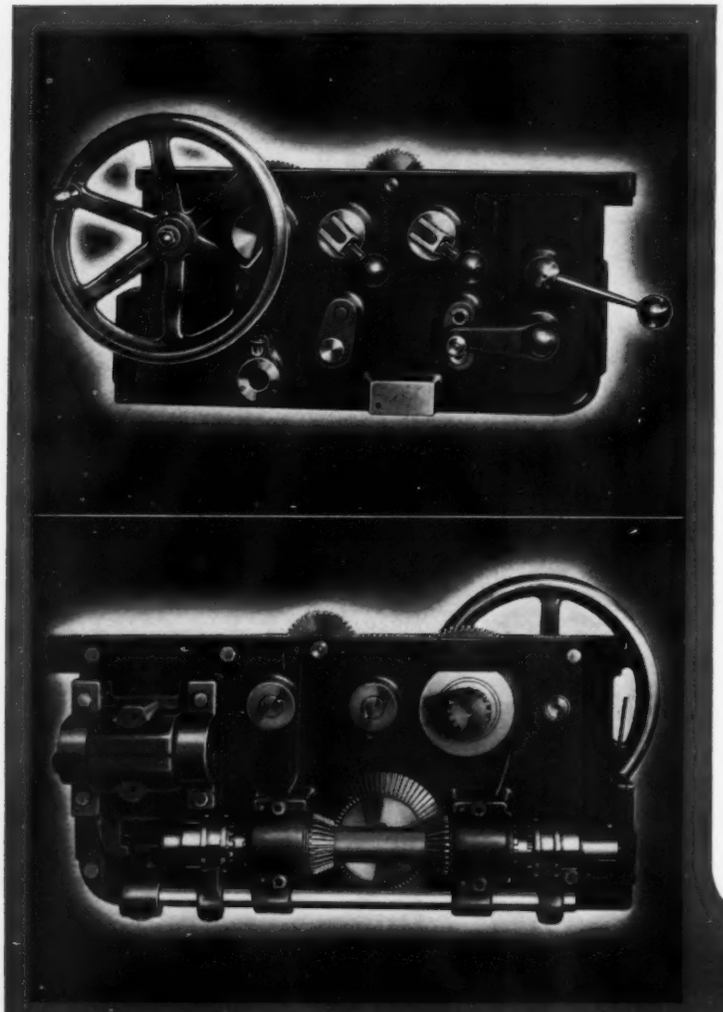
Machine recommended by tap makers.

Forty-five years of continuous operating gives Baush the experience to engineer and build the proper Drilling, Boring and Tapping Machines for your needs.

BAUSH MACHINE TOOL COMPANY

SPRINGFIELD, MASS. DETROIT, MICH.

DOUBLE WALL APRON • • • ANOTHER STURDY FEATURE OF

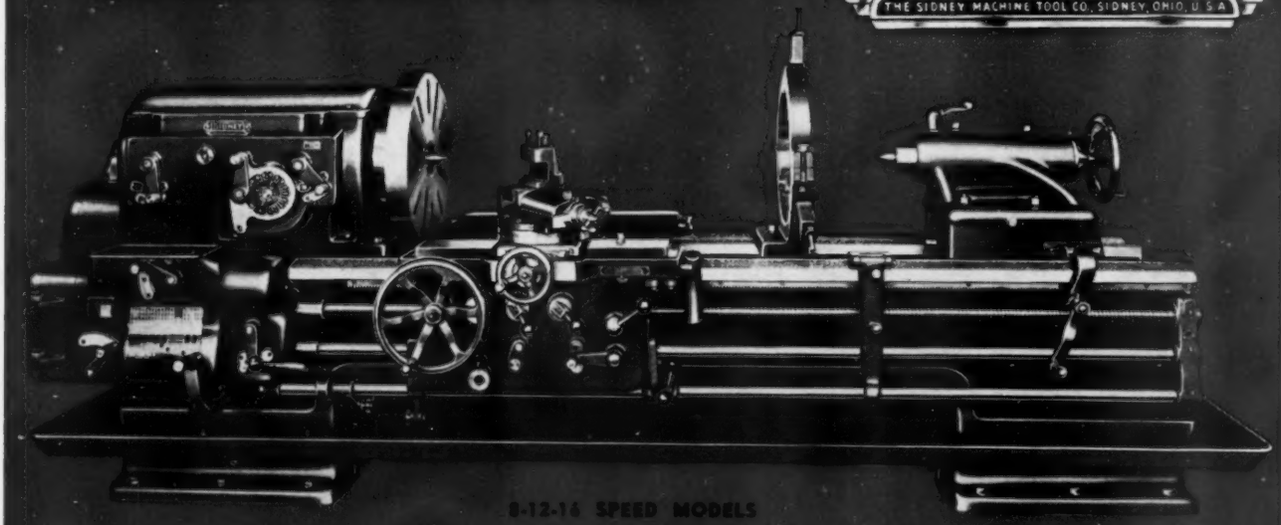


Sidney Lathes

The Double Wall Apron is another point indicative of the modern design and sturdy construction of Sidney Lathes. This double wall Apron provides support to both ends of the heat treated shafts on which alloy steel gears are carried. Rack pinion and all shafts are anti-friction mounted. Snap levers actuating serrated tooth clutches control longitudinal and cross feeds. All controls are conveniently located for quick, easy operation.

Bulletins for this and other models immediately available

SIDNEY
THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U.S.A.

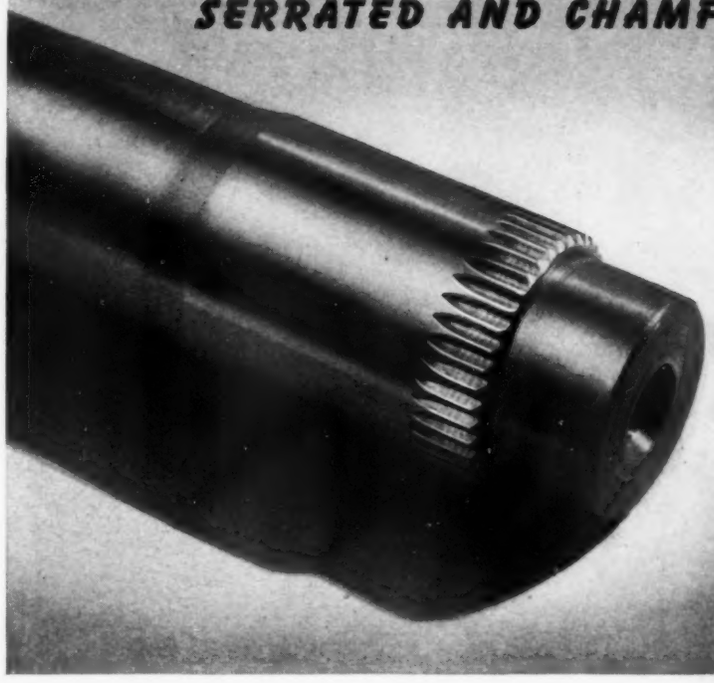


8-12-16 SPEED MODELS
14"-36" CAPACITY RANGE

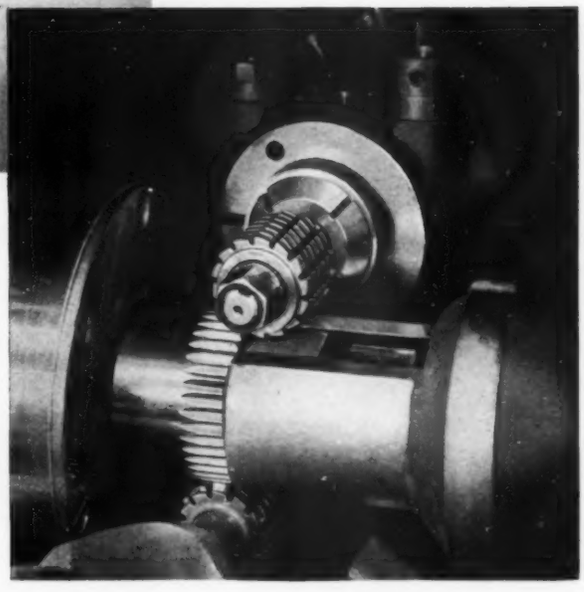
The SIDNEY MACHINE TOOL Company
SIDNEY U.S.A. OHIO

ONE EVERY 2½ MINUTES

MACHINE GUN BARRELS SERRATED AND CHAMFERED ON...



BARBER-COLMAN HOBBING MACHINES



This close-up shows the special tooling for locating the work accurately in minimum time. The barrels are held in a non-floating collet with air cylinder attachment and are loaded from the rear. The end locates against a split collar stop as shown.

UNUSUAL TYPE MACHINE USED

THIS small, but important, operation on machine gun barrels has been speeded up in several war production plants by the use of special Barber-Colman Type "A" Hobbing Machines fitted with dual hob spindles. The hob on the lower spindle cuts the serrations and the special hob on the upper spindle chamfers the ends, producing a finished piece in one cut and eliminating the separate chamfering operation. This is only one example of the many ways in which B-C products are speeding the country's war efforts.

MACHINE SET-UP AND PRODUCTION DATA

Piece — machine gun barrel, SAE 4150 steel, 293 Brinell, 1.676" O.D., 40 serrations 90° x .054", length of cut 15/32".

Operation — serrate and chamfer in one finishing cut.

Set-up — Feed, cam-operated, .040" per rev. of work; hob speed 240 r.p.m.

Cutting time — 1.9 min.; loading time — .5 min.

Production — 21 pieces per hour, average, at 85% efficiency.

Hobs — serrating, B-C 1" x 1-1/2" on shank, ground, single thread.
— chamfering, B-C 1" x 1" x 7/16" hole, unground, single thread.

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

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Designed for the rapid production of small parts, Simmons No. 1A Micro-speed Milling Machine is efficient and simple to operate. By means of Micro-Speed Drive, (our own variable speed transmission) and Selector Dial Control, any speed in its wide range—56 to 630 R.P.M.—may be instantly obtained at a turn of the handwheel adjacent to the selector dial on the column.

Thus the operator is assured the right speed for the job. And that means higher precision . . . faster, more economical production! Write TODAY for descriptive bulletin.

SPEEDS:
56-630 R.P.M.

RANGE OF FEEDS:
Horizontal, 34"
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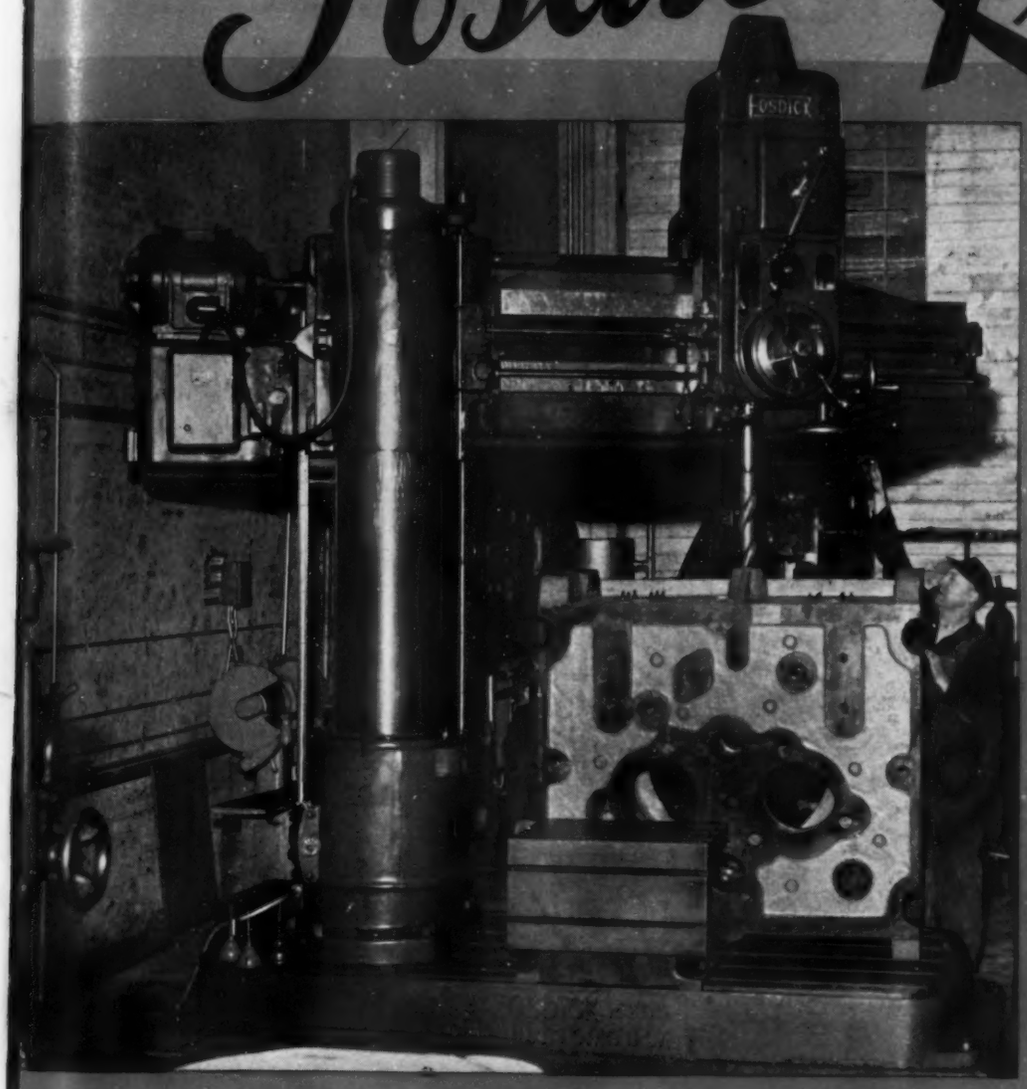
Fosdick Radial



DISPLAYS VERSATILITY ON HEAVY DIESEL ENGINE WORK IN CONTRACT SHOP

★

• Drilling and tapping a large number of various sized holes, and spot facing bosses are a few of the many operations performed by this Fosdick Radial on this cylinder head for a 6 cylinder 6,000 H.P. diesel engine.

This is a contract job and the contractor likes the way this Fosdick Radial handles a large number of varied operations quickly—efficiently—at low cost.

Many plants working 24 hours a day on War contracts are having equally satisfactory results with Fosdick Radials—so can you.

WRITE for full descriptive and completely illustrated Bulletin Fosdick Radial Drills—RA.

FOSDICK MACHINE TOOL COMPANY
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To Finish The Job Quicker . . .

SOLVE LABOR

PLACING THESE

SHORTAGE PROBLEMS BY

TOGETHER LIKE THIS

Is your production suffering because of a labor shortage? In many plants this problem simply must be overcome in order that the upward swing in production can be continued.

Like other problems facing American industry this one will be licked. Here is one way to do it --

Enlist the aid of the thousands of American women who are eager to serve their country as production soldiers. Put them to work in your plant—together they will form a battalion that will release great numbers of skilled male workers for other more strenuous jobs. As for their ability to operate machines, well, here is the actual experience of a well-known manufacturer of chucks.

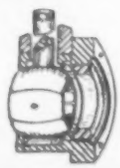
He is grinding chuck jaws on Landis 4" Type H Plain Hydraulic Grinders operated by comparatively inexperienced female employees. He reports as follows: "Since the installation of these Landis machines, production has increased 35%, a power saving of 30% has been effected and wheel life has been greatly extended. Maintenance records have been very low."

Perhaps, if you have a labor shortage problem, it can be solved in a similar manner. But remember—for best results choose grinding machines that are easy to set up and operate, and that can be used continuously without the need for time-consuming readjustment and repair. Or, more specifically, for best results choose Landis Grinders.

Unusual Performance As Usual

PRECISION LANDIS GRINDERS

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.



MICROSPHERE WHEEL SPINDLE BEARINGS

CYCLE CONTROL LEVER

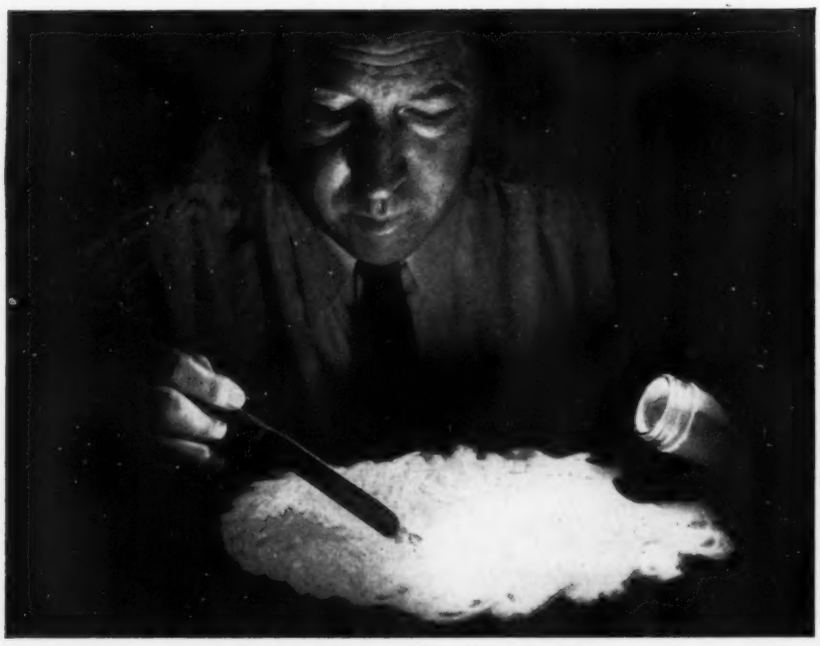
VARIABLE VOLTAGE HEADSTOCK

395

Why G-E Fluorescent Lamps "stay brighter longer"

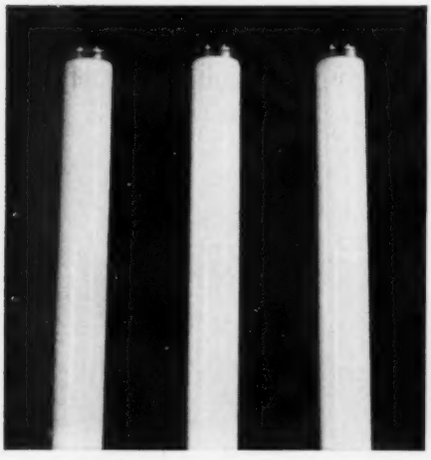
A PICTURE STORY THAT'S WORTH READING. You want as much light for your money as you can get . . . to help speed war production, reduce waste, and avoid accidents.

Here are just a few of the reasons G-E MAZDA F lamps are better today than ever before—why they give such dependable service—why they stay brighter longer.



1 DR. W. A. ROBERTS OF G-E LAMP DEVELOPMENT LABORATORY is studying the synthetic phosphors used in coating G-E MAZDA Fluorescent lamps to make them *stay brighter longer.* Up to June 1, General Electric had put approximately 450,000 man-hours of research into Fluorescent lamp improvements with the objective of giving the user more and more light for less and less cost.

2 A TINY DROP OF MERCURY like this is accurately measured and safely injected into G-E MAZDA F lamps by an automatic machine specially designed by G-E engineers. Results: lower cost and improved operation.



3 UNRETOUCHED PHOTO of 3 40-watt G-E MAZDA F lamps. One is brand new, second has burned 2030 hours, third has burned 2650 hours (150 hours over rated life). Note absence of end-blackening.

4 GREATER COLOR UNIFORMITY is assured when controlled and checked by "electric eyes" with color filters . . . one of many routine checks in General Electric's Fluorescent lamp factories.

5 WHEN YOU BUY fluorescent lamps, look for the G-E monogram. It means they *stay brighter longer.* For best results it is advisable that you always use certified lighting equipment.

G-E MAZDA LAMPS **GENERAL ELECTRIC**

HERE'S ONE REASON

why one Yankee pilot is "worth a dozen Japs"

THE big ring is an American aircraft engine in embryo. The hands are doing a routine, high-speed inspection job — plug-gaging a hole. That's precision in the making . . . accuracy to .00010" coming up . . . one reason why American pilots will soon rule the skies of all the world.

That's a Pratt & Whitney plug gage . . . no laboratory toy, but a calloused, hard-working *production* tool that does its job and comes up smiling. Heat-treated for *enduring* service, finished for uncanny *accuracy*, it's typical of P&W precision products now building America's strength for Victory.

There's one catch: as things stand now, there *are* a "dozen Japs," more or less, for every well-equipped Yankee in the battle zone. *So don't spare the pressure . . . keep 'em rolling.* Your P&W tools can take it.

P&W Photo—Untouched

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

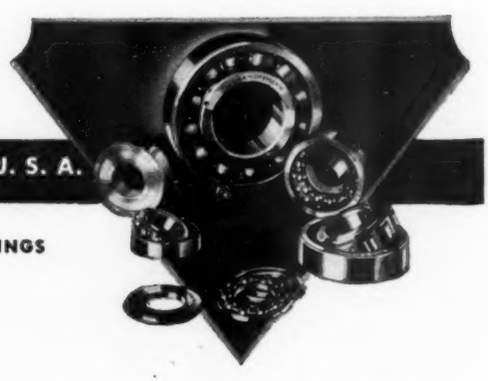
YOUR MACHINE EQUIPMENT

A treacherous, insidious saboteur lurks in every plant engaged in war production, alert to every opportunity to damage your machines and curtail your output. FRICTION is his name, and your only safeguard against him is the vigilant protection of F.B.I.—FREQUENT BEARING INSPECTION.

Keep all bearings clean and well lubricated. Exclude dust, dirt and moisture. Use only high-grade lubricants. Watch for the first signs of unusual heat or noise or looseness in the bearings. If possible, keep replacement bearings at hand, for a quick substitution if needed. America, in her vast war program, cannot afford to lose a single machine-hour of production. Guard against such losses by FREQUENT BEARING INSPECTION.

We will gladly cooperate with you in maintaining or increasing your production—by experienced counsel on the use and care of anti-friction bearings, and by supplying you, wherever possible, NORMA-HOFFMANN PRECISION BEARINGS for replacements.

Write for the Catalog. Let our engineers work with you.



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PRECISION BALL, ROLLER AND THRUST BEARINGS

A BRAIN THAT'S ALWAYS *Clear*

CLEAR OF DIRT
CLEAR OF CHIPS
CLEAR OF COOLANT

Multiple spindle Conomatics have a brain that's always clear. This brain is the camshaft which is located overhead in the top bed. This exclusive Cone feature is a time saver. It is free from dirt, chips, and coolant, yet easily accessible. These features result in minimum wear and maintenance — simplify quick job changeovers.

A clear brain is essential to fast, dependable action. A time study of your own parts will show you just how fast a Conomatic can be. They are built with 4, 6, and 8 spindles.

Write, wire, or phone for further information.

CONE

AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT
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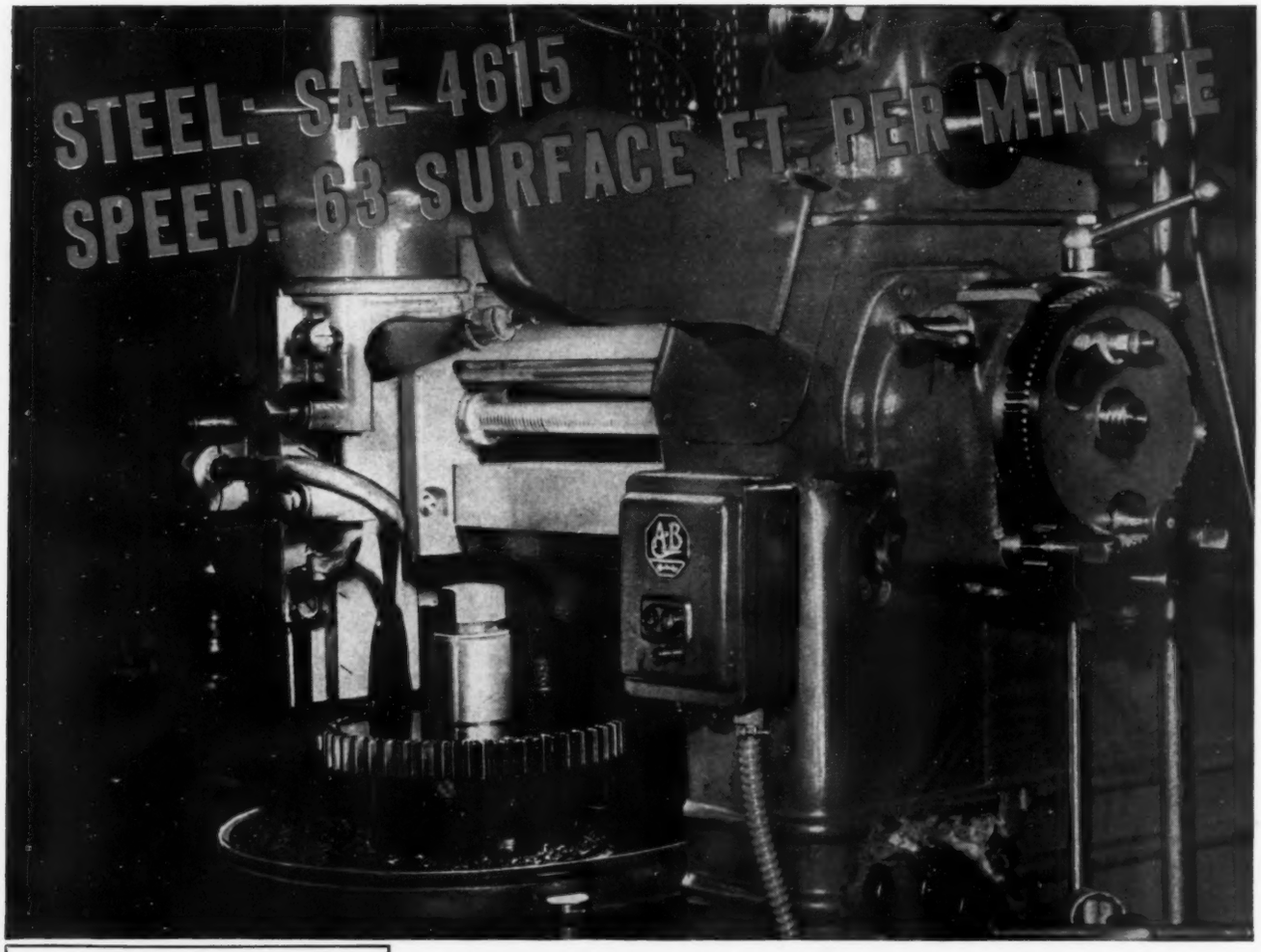

Cutting molybdenum gear teeth at high speed. "Moly" puts machine tools and cutters "on their mettle." For all hard, tough materials, use *Texaco Sultex* or *Transultex Oils.*

SIX-PITCH spur gears of molybdenum steel are being cut in 6A-type Fellows Gear Shapers, at a cutter speed of 63 surface feet per minute. The cutting oil used to get this result is *TEXACO SULTEX!*

On war work everywhere, *Texaco Sultex Cutting Oils* are increasing output, lengthening tool life, decreasing down-time, improving finish.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal-cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York, N.Y.

Care for your Car ..for your Country

Tune in the TEXACO STAR THEATRE every Sunday night—CBS

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

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TEXACO Cutting Oils
FOR THE METAL-WORKING INDUSTRY

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Industrial
DRILLING
Practices...
SUPER SERVICE
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AIR STATION
CINCINNATI BICKFORD
Here, as in industry, it is necessary to get the most possible work out of the least possible space and power.
The versatility of this 3' arm, 9" dia. column machine is due to its special base, with box and universal tables. Drilling, reaming and tapping of large pieces are facilitated on the base, small pieces on either of the tables, odd angle operations in small pieces are accomplished with the universal table. Sometimes two operators run one machine; one operator sets up a job on one table while the other operator is processing a job already set up on either the base or the other table.
For further information about your metal drilling problems don't hesitate to get in touch with us.
THE CINCINNATI BICKFORD TOOL CO.
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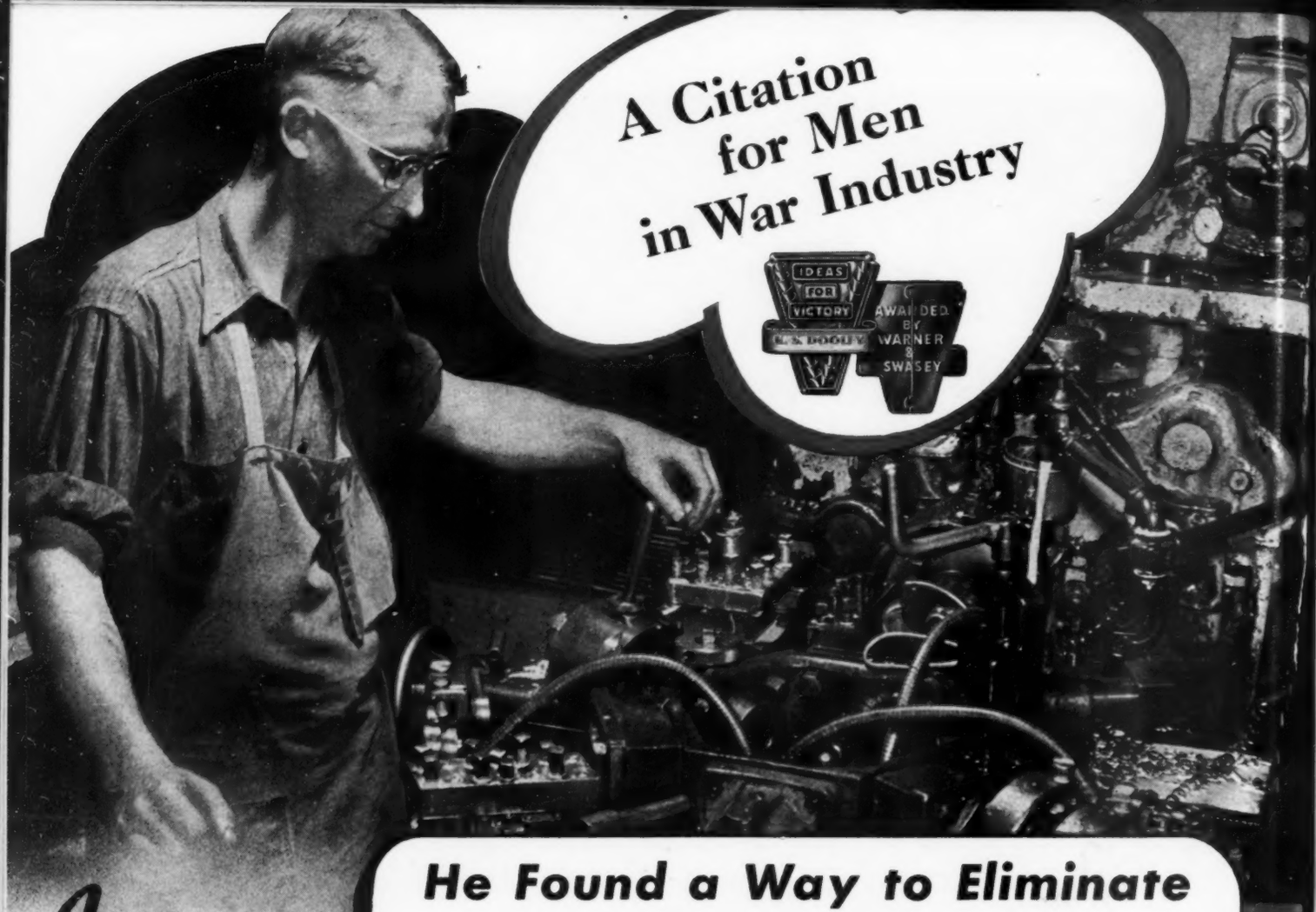
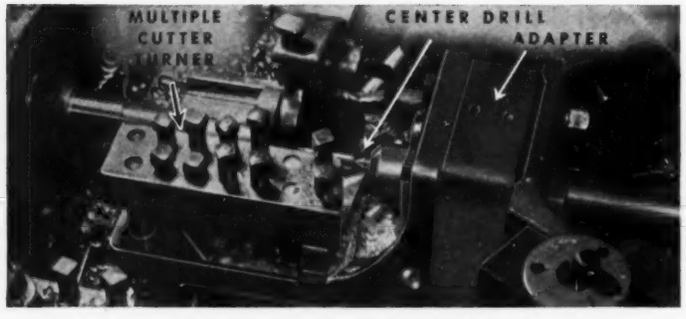


Ideas for VICTORY

—from the Production Lines behind the Firing Lines—

He Found a Way to Eliminate an Indexing Operation



Two set screws hold the drill holder solidly in the adapter. The rolls of the multiple cutter turner act as a steady support for the bar as the drilling cut progresses.

Turret lathe operator Karl S. Dooley, at the Caterpillar Tractor Co., Peoria, offers an idea particularly valuable to the operator who has all six turret stations full and still requires a center drilling operation to complete the job in one chucking.

The photo shows how a centering tool was rigged up and held in the multiple cutter turner. The center drilling is performed at the same time the last of several finished diameters is turned.

It takes real initiative and ingenuity to work out a time-saving idea like this and we are proud to present operator Dooley with a gold Victory pin for his contribution.

Many practical "Ideas for Victory" sent in by operators are published in "Blue Chips", a shop bulletin sent by Warner & Swasey to the homes of turret lathe operators. Make sure your turret lathe operators and learners are on the list to receive "Blue Chips" Write Warner & Swasey, Cleveland, Ohio.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

M. D. BASOLO, Lockheed wood shop foreman, whose development work resulted in the use of plastics for drill jigs

PLASTIC TOOLS

While the usefulness of plastics has increased widely in the last few years, no one visualized the extent of their application to jigs and dies before the present war. Under the stress of emergency production, Lockheed and Vega engineers experimented with many plastic materials and have now found a satisfactory solution to their search. Plastics are used which can be readily molded to irregularly shaped aircraft parts, greatly reducing the time and cost of making tools. Page 731.

WORKING WITH WASHINGTON

How to get orders from governmental departments, how to get materials to fill these orders and how to finance them is involved in a maze of rules and regulations that is often difficult to penetrate. A special section devoted to spreading light on this urgent subject will be found in this issue. This is no theoretical discussion but a direct guide telling where to go, whom to see and what to do. Page 742m.

ROLLER COATING

Large bombers and transport planes have a lot of surfaces which must be painted inside and out. The process of painting has been speeded greatly by the use of rolls in place of the usual spray gun. A continuous machine has been devised which cleans the dural sheets as received and paints them on both sides. This method has been found, by the Douglas Aircraft Company, to save 3,000 man-hours per plane. Page 730.

CAMS, CONCLUDED

H. A. Frommelt, director of industrial research, Kearney and Trecker Corporation, finishes his six-part series on cam milling with a description of the applications of pivoted beam cams. This information, not usually discussed in texts on machine design, will be found useful in practice. Page 709.

20-MM. GUN

A good example of beating plowshares into swords is the current production of 20-mm. Hispano-Suiza aircraft cannon by the International Harvester Company. Our armament section describes machining operations on important parts of this weapon, which is designed to add striking power to our air force. The method of tooling is shown in detail. Page 715.

TOOL ELEMENTS

There seems to be no end to the demand for practical data on tool engineering. This number starts a new four-part series on jigs and fixture details by John G. Jergens, Cleveland Pneumatic Tool Company. Mr. Jergens has the happy faculty of making his points quickly and concisely by the use of sketches and short captions. Page 704.

TRANSLATING THREADS

Ordinary screw threads are designed simply to hold parts together. Translating threads supply motion to operating mechanisms. Since their function is different, their thread form must be distinctive. A new standard on these threads has recently been approved by the American Standards Association. Two pages of the standard appear in this number. Pages 739 and 741.

FABRICATED SCRAPERS

Flame-cut, arc welded construction as applied to machinery of many types is now so well established that it is no surprise to see another new application adopted. This method of fabrication lends itself readily to road-building machinery, particularly scrapers. The technique of manufacture is described by word and picture in an article by Herbert Chase. Page 706.

ALFRED M. COOPER

SHOP LEADERS

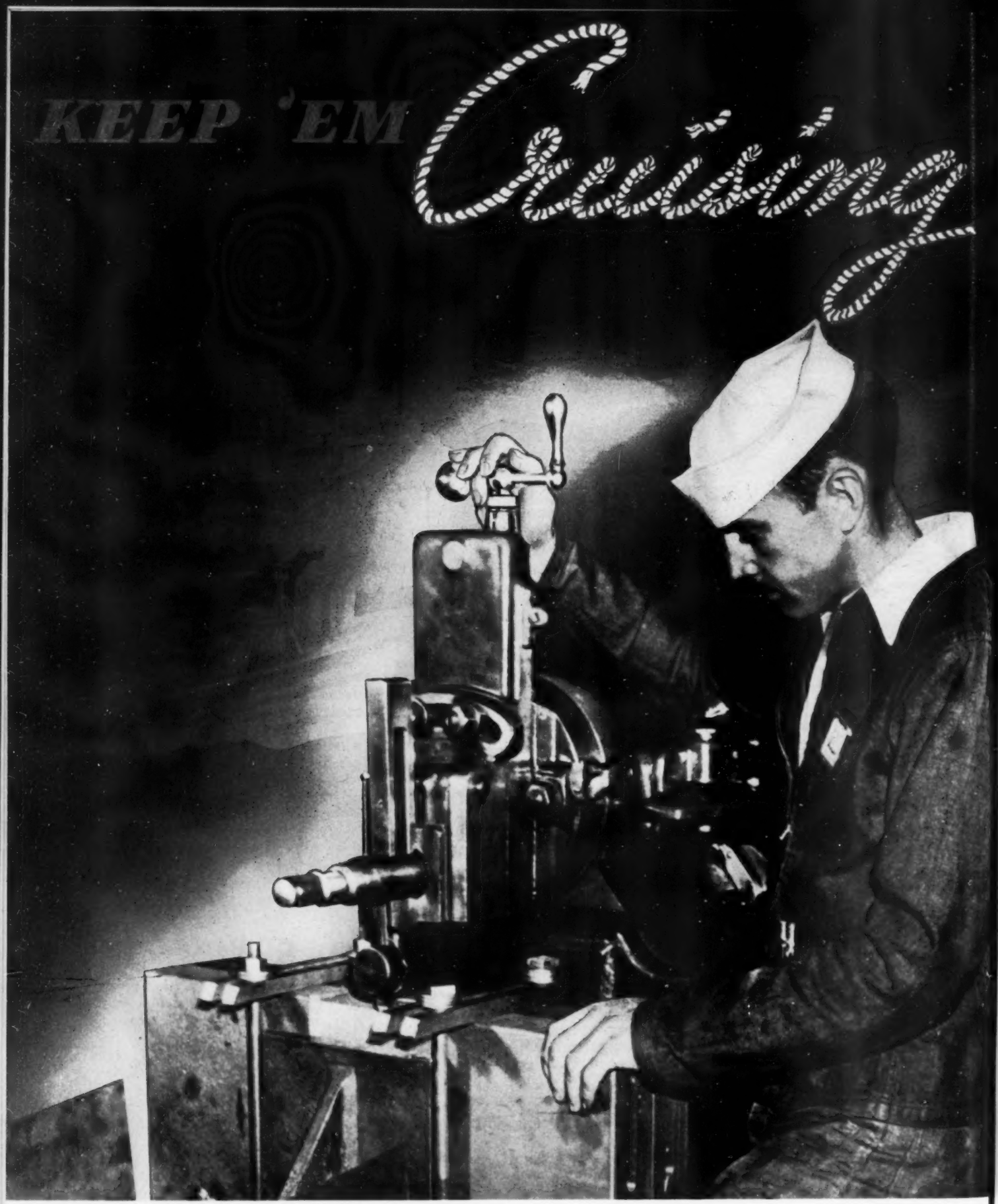
Our army of industrial workers must have its officers and non-coms. Their supervisory guidance in our manufacturing plants is just as important to production as leadership on the field of battle is to victory.

With an estimated million new supervisors to train, conventional methods must be abandoned. The conference system, so successful when a preponderance of experienced supervisors had only to absorb a small percentage of new recruits, leaves something to be desired today. Alfred M. Cooper suggests a program in which the conference method is supplemented by intensive training. Page 701.

COMING

Everyone is saving materials today, but to get maximum value from them they must be carefully segregated. Wright Aeronautical Corporation has set up a special system for doing this. The efficiency of this plan preserves waste metal for the nation's use and brings maximum return to the company. It will be described in an early number.

One of the mass-production operations of this war is the manufacture of fuzes. An early armament section will be devoted to the production of percussion fuzes by a large carburetor manufacturer. Two types will be described, one American and one British. Many novel tool set-ups are employed.



CINCINNATI SHAPERS, ashore and afloat, are helping to build and to maintain our battle fleets.

THE CINCINNATI SHAPER CO. • CINCINNATI, OHIO

OFFICIAL U.S. NAVY PHOTO

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Job hunters outside the personnel office at Lockheed. It is estimated that for every eight new workers absorbed into industry, one new supervisor is needed. If proper supervision is lacking, production drops and accidents increase

WANTED:
One Million Supervisors

BY ALFRED M. COOPER

Defective work resulting from inadequate supervision is the fear of plant managers today

IN 1942 American industry must employ eight million new workers. To direct the efforts of this vast army of green hands there will be required, at a most conservative estimate, one million brand new supervisors.

Greater even than the necessity of securing the skills needed for defense production is now the problem facing industrial management of developing quickly a supervisory force capable of handling and training these new employees. If for no other reason, it is imperative that these new supervisors be trained in order that a stop be put to the appalling increase in frequency and severity of injuries to our workers.

Poor supervision is enormously expensive. Whenever a newly appointed foreman or straw boss fails as a supervisor, you may expect sharp increases in accidents to workers. There will be increased spoilage of material, defective workmanship, and augmented dissatisfaction among this man's subordinates. The result of all these, in terms of loss of production, is equivalent to a skillfully planned sabotage program.

As the superintendent of the inspection division of a large airplane fac-

tory recently said to me, "It isn't sabotage, or the threat of sabotage, that's putting gray hairs in my head. It's unintentionally defective workmanship, and the fear that the resulting defective equipment will get past inspection and find its way into a bomber, that is my particular private nightmare. And behind this defective work invariably there exists poor supervision."

Training by Discussion

In normal times industrial management has concentrated its efforts on upgrading existing foremen and supervisors by training them in improved methods of supervision. This has been accomplished by means of foremanship training conferences, in which, through discussion, these men have developed new ideas for improving their methods of handling subordinates. No effort ever has been made, either in industry or in our schools and colleges, to train inexperienced people as supervisors.

But the situation which now confronts us is utterly different. Now we will have a million new supervisors, many of whom must take charge of entire departments; yet few of these people ever have given a single order to a subordinate in their workaday lives! How are these neophytes in supervision to be trained, quickly and effectively, in methods of directing the efforts of others safely, and with a minimum of production loss and ill-feeling among the workers reporting to them?

Like many of the "impossible" things we are doing every day in our defense effort, this too can be accomplished. But action must be taken at once, and this action must be intelligently effective, otherwise the influx of inexperienced supervisors in industry will soon prove an appalling handicap to all-out production.

It goes without saying that these new supervisors do not need training in the mechanical operations performed by those whose work they will supervise. They have been doing that sort of work for months—perhaps even for years. They are, no doubt, experts at it. What these green supervisors need is training in *supervision:* the art and science of handling subordinates.

In the past quarter-century I have led foremanship conferences with several thousand supervisors in many industries. I learned something about supervision from these people. The suggestions which follow, wherein a new and entirely different type of supervisory training is recommended to meet the present emergency, are based on what I learned from these supervisors.

Foremanship training by conference method is successful only when the supervisors under instruction have had years of practical experience on which to draw for their participation in discussion. No program of conference training can be effective when the discussion groups are made up of people with no experience in the subject under discussion—in this case the proper handling of subordinates.

Therefore, the conference method of training foremen must be abandoned, insofar as this million of brand new supervisors is concerned. For this method must be substituted, in each plant concerned, a series of lectures, definite reading and home-study assignments, and personal, organized, on-the-job coaching of rookie supervisors by the old-timers of the plant's supervisory force.

The only exception to the foregoing should occur in cases in which the older supervisors of an organization are at present undergoing foremanship training by conference method. In such instances, it is permissible to induct a few of the new supervisors into each discussion group made up principally of experienced foremen. By listening to the discussions of the older men while rarely taking any part in them, the neophytes may learn much. However, not more than one-third of any foremanship discussion group ever should consist of green supervisors, otherwise no one will benefit from attendance at these meetings.

AVOID THESE DANGERS

Poor supervision is enormously expensive — among the costs:

1. **Increased Accidents**
2. **Material Spoilage**
3. **Defective Workmanship**
4. **Worker Dissatisfaction**

The training course for embryo supervisors should be continuously in effect, with new classes beginning each week, or as often as expansion of personnel creates a new batch of supervisors. This training should be under the direction of the plant training department or the personnel department, but in addition many executives of the organization will cooperate in making the undertaking successful. The safety engineer, in particular, must be prepared to devote much time to special lectures on the subject of accident prevention, as one important phase of the training of inexperienced supervisors.

The new supervisors must meet in class, either during or after working hours, at least three times weekly during the initial, and most vital, part of their training. After a month of this they will attend weekly meetings for a period of several months.

In the initial twelve meetings of this new-type foremanship training course, instruction will follow an outline very similar to that of the conventional conference type of supervisory training course. A suggested list of lectures for these introductory meetings would be:

(1) Analyzing the supervisor's job.
(2) Balanced and complete supervision.
(3) Orders, directions, and suggestions.
(4) The cost elements of supervision.
(5) Physical condition of subordinates: Health.
(6) Physical condition of subordinates: Accident prevention.
(7) Physical condition of subordinates: Accident prevention.
(8) Mental attitude of subordinates: Morale.
(9) Mental attitude of subordinates: Morale.
(10) Cooperation, Horizontal.
(11) Cooperation, Vertical.
(12) Training subordinates.

Here, in twelve meetings held within a period of 30 days, the green supervisors are given a quick grasp of the fundamentals of good supervision. In general, the subjects included in this introductory course are about the same as those covered in a regular foremanship training course. The only difference is that the material will be presented wholly by lecture, rather than by conference presentation.

The opening four lectures must be delivered by the man who has been conducting foremanship conferences in the plant in question. This foremanship trainer is best qualified to discuss the subjects embraced under the first four headings in the course outline, since these subjects are standard as a part of any good foremanship training program. He will, of course, avoid all conference technique, and stick to straight lecture in his presentation.

Quick Orientation Needed

Following the four introductory lectures the safety engineer will take over for three meetings, during which health and accident prevention will form the subjects for discussion. In his talks the safety man will hammer on the necessity for the new supervisor to be eternally vigilant in all matters pertain-

ing to safety. The medical director also may lecture on matters pertaining to the health of the employees.

The lectures on "Mental attitude" and "Cooperation" can be effectively delivered by various other executives of the company, preferably officials near the top of the organization. At each meeting a different executive may speak on human-factor supervision. Any executive who is not bubbling over with ideas about the development of morale and cooperation among the working force is working in the wrong job. Actually any executive, from the general manager down, will be glad to devote an occasional hour to upgrading his new supervisors.

The foregoing series of lectures will help materially in getting these new supervisors quickly oriented in their jobs. In itself, however, this instruction will not be sufficient to obviate the serious errors of commission and omission of which every green supervisor is guilty. It must be supplemented by additional effort on the part of everyone concerned.

Enlist Older Supervisor's Help

Thus, a meeting of all the *older* supervisors in the plant should now be called, and this group addressed by the general manager, or other high company executive. In this meeting, an appeal is made to these experienced supervisors to the effect that they make exceptional effort to help the newly appointed supervisors in carrying out their duties.

The old-timers will respond to such an appeal and will go out of their way to smooth the road for the brand new supervisors. Since, in many cases, the newly created foremen are reporting to the older ones, this cooperative situation will be an entirely natural and logical one.

However, it would be a serious error to put full dependence on this cooperative effort of the older supervisors and eliminate the formal training of the new foremen. The older heads can help, but they have too many other important duties to be expected to put in most of their time nursing a bunch of green subordinate supervisors. No, this is a training job, just as much as that of developing the essential skills in a young man about to take his place on the production floor as a lathe hand.

Supplement the lectures on foremanship with reading assignments of a number of good books on the subject of supervision and industrial management. Don't assign reading in subjects that are far beyond the immediate interest or sphere of these new supervisors. Don't expect them to show intelligent interest in weighty problems of administration and executive control before they have mastered the rudiments of elementary supervision. Confine the reading assignments to subjects they may apply in their everyday work.

At the end of 30 days the newly created supervisor has received intensive training in supervision, has had full cooperation from the older supervisors, and has, in addition, read and studied much that will help him get a better grasp of his new job. None of this training has been haphazard. The supervisory force is receiving the same careful training as is the remainder of the working force.

When the new supervisors have completed the 30-day training period as outlined in the foregoing, they should at once be formed into regular conference foremanship training groups. These conferences should be conducted weekly or biweekly, for an indefinite period of time. All discussion at these meetings should be confined to problems directly relating to supervision.

By taking action in the matter of training green supervisors, you will have sharply reduced the frequency and severity rates of accidents to workers, eliminated much of the defective workmanship and material spoilage which inevitably accompany poor supervision, and obviated much dissatisfaction among improperly supervised employees.

SEVEN SUGGESTIONS
ABOUT TRAINING SUPERVISORS

1. What green supervisors need is not training in mechanics, but training in supervision.

2. The conference method of training foremen is of no value with inexperienced men.

3. New supervisors should be trained as soon as they start to work.

4. Training should aim first to give them a quick grasp of fundamentals.

5. An appeal should be made to older supervisors to help the new men carry out their duties.

6. Direct training should be supplemented by outside reading. Don't assign reading beyond the sphere of interest of supervision.

7. After the basic training, new men should be formed into regular conference training groups.

Residual Stress Relieved In Tierods

Residual stress in cold-worked streamline tierods for airplanes was found to be so distributed as to act in the same direction as the superimposed service stresses. An investigation has been made to determine whether the residual stresses could be relieved by low-temperature heat-treatment without lowering physical properties.

According to the June *Journal of Research* about two-thirds of the residual stress in SAE 1050 steel tierods can be relieved by heating 30 min. at 600 F. without materially lowering mechanical properties.

Cold-worked austenitic stainless steel tierods also can be heated at temperatures high enough to relieve most of the residual stress without detriment. For 18-8 steel, however, heat-treatment probably would be limited to temperatures below the precipitation range of chromium carbide. This temperature was found to be about 900 F. for a heating period of 30 min. Tierods containing additions of titanium, columbium, or molybdenum may be heated at higher temperatures, since the carbides of these elements are precipitated in preference to chromium carbide.

A possible explanation of the residual-stress distribution was noted during the investigation in the X-bands contained in the cross-sections of the cold-worked tierods. Microscopic examination and Vickers indentation tests indicate that the metal within the X-bands had been more severly cold-worked than in areas outside these bands.

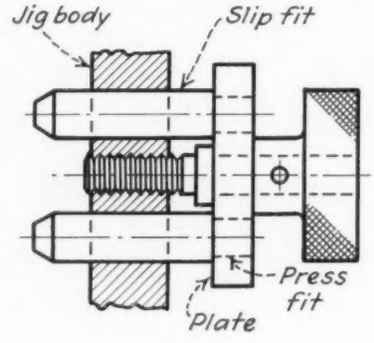
Jig and Fixture Details—I

BY JOHN G. JERGENS, CLEVELAND PNEUMATIC TOOL COMPANY

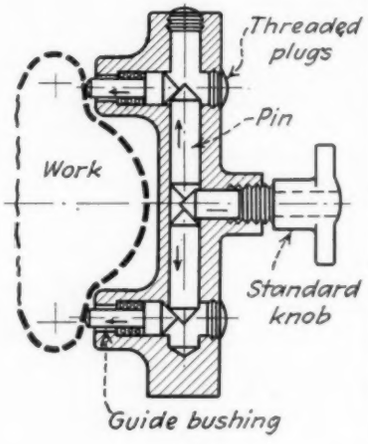
INCLUDED IN this series of jig and fixture details will be equalizing devices, leaf details, indexing pins and clamps, support jacks and vise jaws. Work clamping devices have been omitted because of the coverage they received in a previous series (*AM*—Vol. 85, pages 750, 802, 852).

The drawings on these pages deal primarily with equalizing devices that employ some form of the lever principle. They are indicative of the variations possible and are not meant to be all-inclusive. The designs shown are generally simple and use standard parts whenever possible.

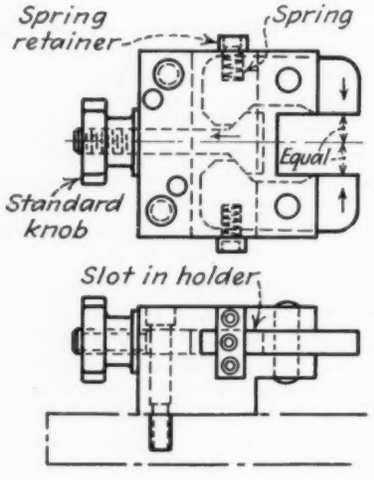
Equalizers of various other types will be illustrated in a later article.



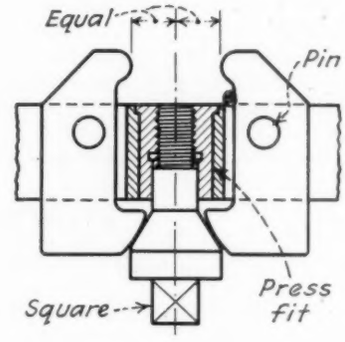
Pressure applied at the center of the plate in this equalizer is distributed equally to the ends of the plate and transmitted by pins to the work



A variation of the plate type equalizer uses intermediate pins to transmit pressure from the center pin to the work holding pins

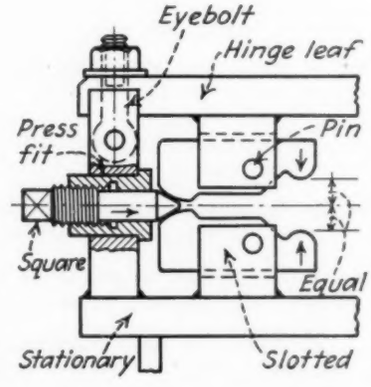


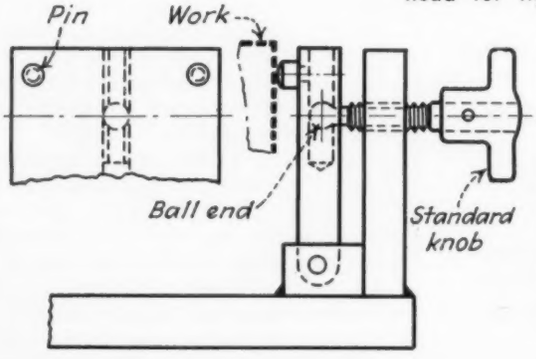
Tightening the knob in this pull type equalizer operates through two levers to exert an equalized gripping, rather than a parallel pressure on the work



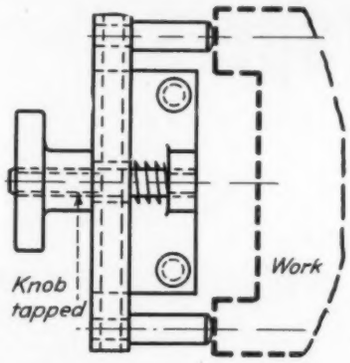
Extreme accuracy is obtainable in this form of the dual lever equalizer. The screw socket is press fitted into a bushing in the fixture

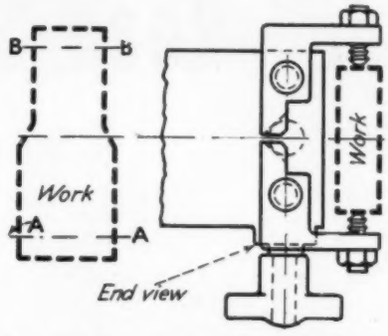
One jaw of this equalizer is attached to a stationary number and one to a hinged leaf. The screw has a square head for tightening with a wrench

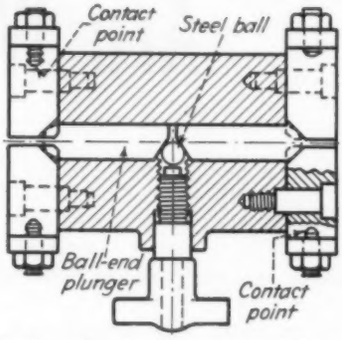




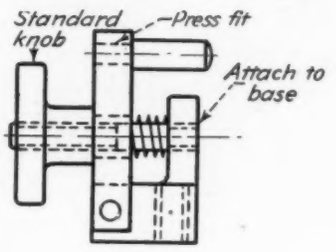
The plate is hinged at the bottom of this equalizer, and pressure from the ball end in the slot is transmitted equally to pins at top corners of the plate



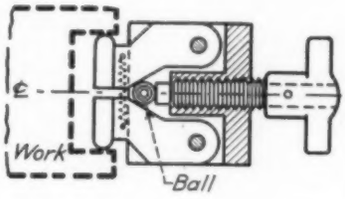




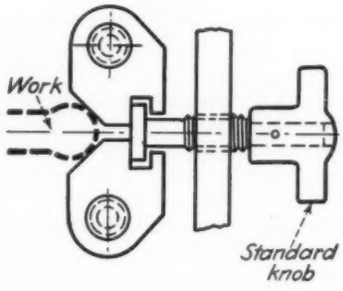
This unusual arrangement equalizes work at both ends simultaneously. The steel ball pushes two ball-end plungers, each of which close swivel jaws upon the casting. When the casting is locked at *AA*, the steel ball will continue to transmit force to the other end until it is locked at *BB*



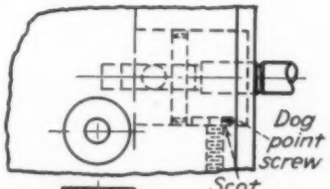
The body of this equalizer is attached to the base of the fixture. Pins to fit the work are set in the top and advanced by turning the knob



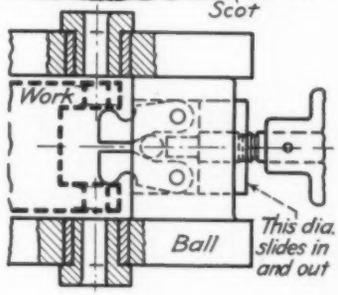
A simpler form of equalizer employing a steel ball, this type will readily compensate for work that may be off center. A spring pulls the jaws together to release work

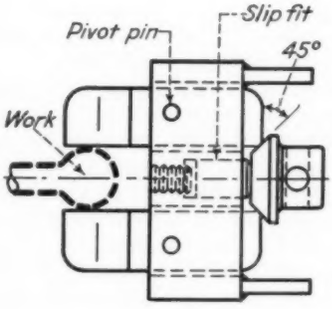


Work with a ball end is held against the jaws of this equalizer. The jaws are attached directly to the fixture body

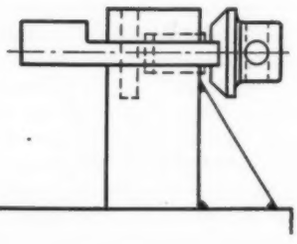


The body of the equalizer is free to slide back and forth in the jig in this arrangement. A screw in the jig fits in a slot and limits travel; tightening this screw locks equalizer

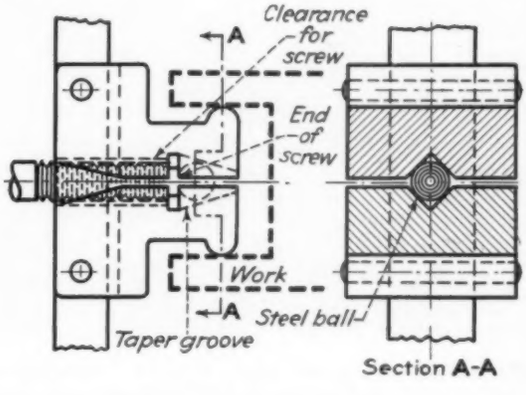




Another form of equalizer for spherical work. The square head of the screw is drilled for a pin to tighten



The steel ball in this arrangement provides a four point equalized pressure against the expanding jaws. Pins at the back of the jaws serve as swivel points



Arc Welded Road Scrapers

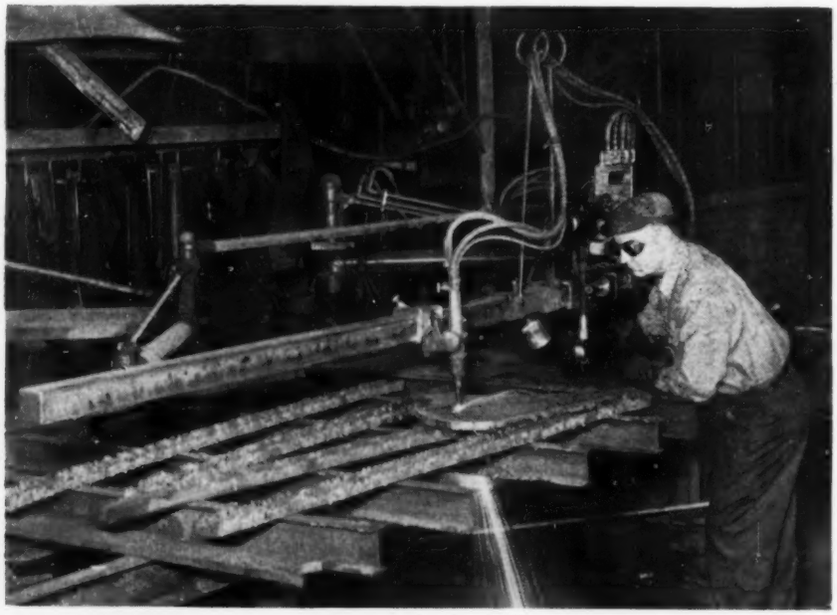
BY HERBERT CHASE

Simple shapes, flame-cut from steel plates, are assembled by arc welding to form heavy-duty road building machinery in Gar Wood Industries' Detroit plant

Few pieces of machinery must withstand more abuse than the large, heavy-duty road scraper. Arc welding plays a large part in their construction

FEW ITEMS of equipment employed in road building, grading and similar operations receive more abuse or require sturdier construction than those termed "scrapers." These wheeled vehicles, which are, in effect, self-loading trailers, are hauled about by heavy tractors. When being loaded, the cutting or scraping edge, at the front of a huge bowl, digs several inches into the soil. Forward motion forces the earth into the bowl and, when the latter is filled, the cutting edge is raised and the load hauled to the dumping point where it is discharged. The whole structure is subjected to severe stresses and often to shocks. These necessitate a type of structure designed for heavy duty with a minimum of upkeep cost.

Several types and sizes of scrapers are manufactured by Gar Wood Industries at one of its Detroit plants. Production and assembly of two of the heavier types are here outlined. Though similar in many features of construction, one of the two is designed for cable control of the cutting edge and the other for hydraulic actuation of this edge as well as of a set of trailing wheels which are lowered when scraping and loading are not in progress.



Many irregularly-shaped parts are cut from plate stock with oxyacetylene torches carried on the arm of a pantograph-type flame cutter. Torch traverse is about 9-in. per min. when cutting ½-in. thick plate

Although some steel forgings and some steel castings of moderate size are used in both assemblies, by far the largest part of the scrapers is fabricated from ¼ to ⅝-in. Yoloy or Ductiloy steel plate. Some structural shapes are also employed. These materials are assembled into the various units by arc welding, partly to insure adequate strength, partly to avoid loosening of joints in service and partly to take advantage of the economies in manufacture which are realized by arc welding.

Major assemblies are built up in a long, high bay of the plant. The lower bays at the side are used for shears which cut the plates to size, for brakes which do what forming is required, for fabricating subassemblies and for doing such supplementary operations as are necessary. Production is on what can be termed on intermediate quantity basis, although the total output in a year is large. For the models described here, it is common to run through lots of about 25 at a time so that a corresponding number of parts can be made in a given run without resetting the machines employed. Most straight line cutting is done on shears, but where the plate needed must have

Reinforcements shaped in a press brake are arc welded to side plates of the scraper, then the subassembly goes to a fixture for assembly with other parts. Coated electrodes are used for all welding operations

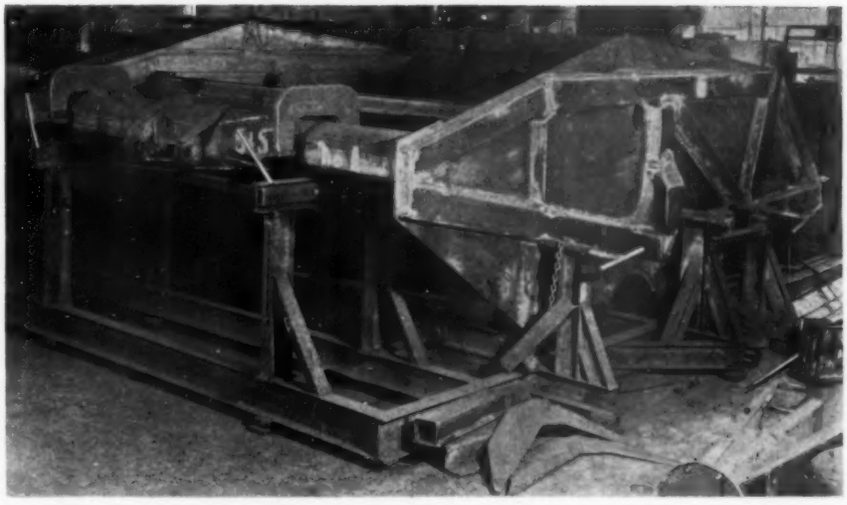
Gate subassemblies are arc welded together after the various parts have been cut and bent to shape. Most of the welding is by hand

curved edges, cutting is done by oxyacetylene torches and extensive use is made of pantograph flame cutting machines.

Where assembly requires or is facilitated by fixtures, these are employed, both to hold the various elements in correct relation during welding and to insure that various dimensions come within required limits. Several scrapers are in process of assembly at the same time and, as the work of assembly progresses, the structures are moved along a line by an overhead crane. Production is not large enough to keep individual welders on repetitive work continuously, but the crews of welders are sufficiently familiar with the various operations they perform in succession to do the work expeditiously.

Cutting with the oxyacetylene flame in the pantograph set-up is done at the rate of about 9-in. per min. in the case of sheets $\frac{1}{2}$-in. thick, once the sheet is in place and the templet ready for use.

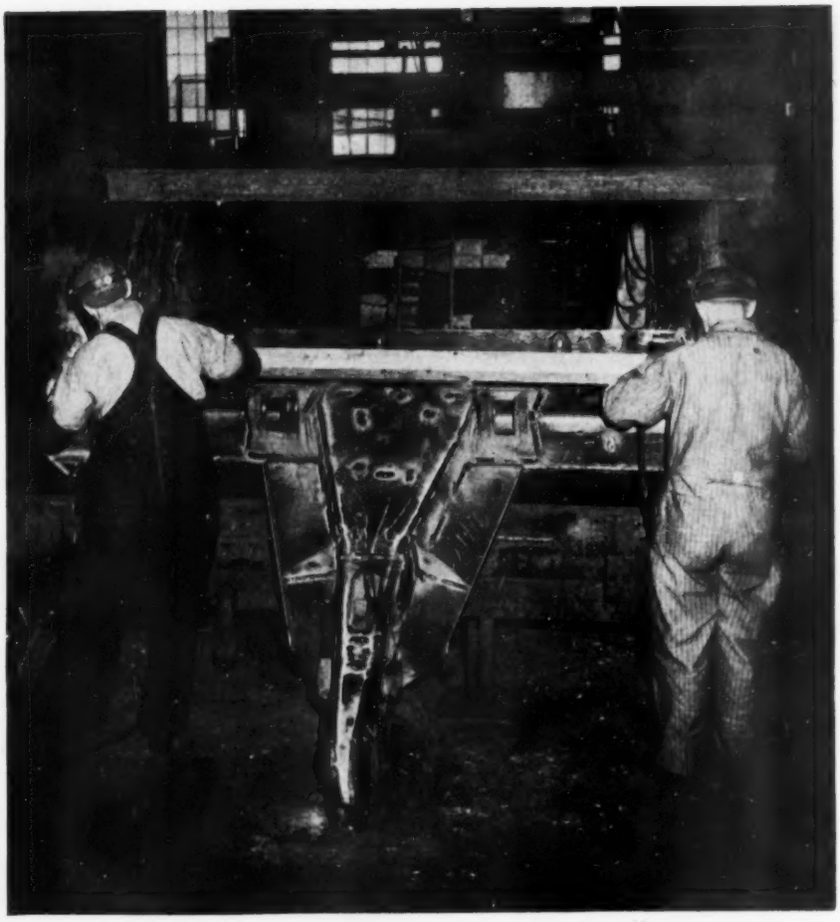
Electrodes employed in making the arc welds on scraper assemblies are of the Hollup coated type and range from $\frac{1}{8}$ to $\frac{5}{16}$ in. in diameter. The average rate of welding approximates 6 in. per min., exclusive of time required for setting up and clamping parts to be welded. It is somewhat slower, naturally, where welds are short or in awkward position, but the percentage of such welding is small. An effort is made to place the work in the most convenient positions permitted by the size and character of assembly. In almost all cases the edges of sheet are cut square and lap joints are used, but where it is necessary to join sheets without an overlap, and to form flat surfaces on each side, the edges of sheets are sheared at a 45-deg. angle, leaving a 90-deg. "trough" which is filled in flush by welding. Most welds are made in corners where sheets cut



Two side frame subassemblies are set up in this fixture for arc welding to parts which form the bowl of the scraper. The large cross-piece in the foreground is a hexagonal-tube subassembly arc welded from two heavy plates

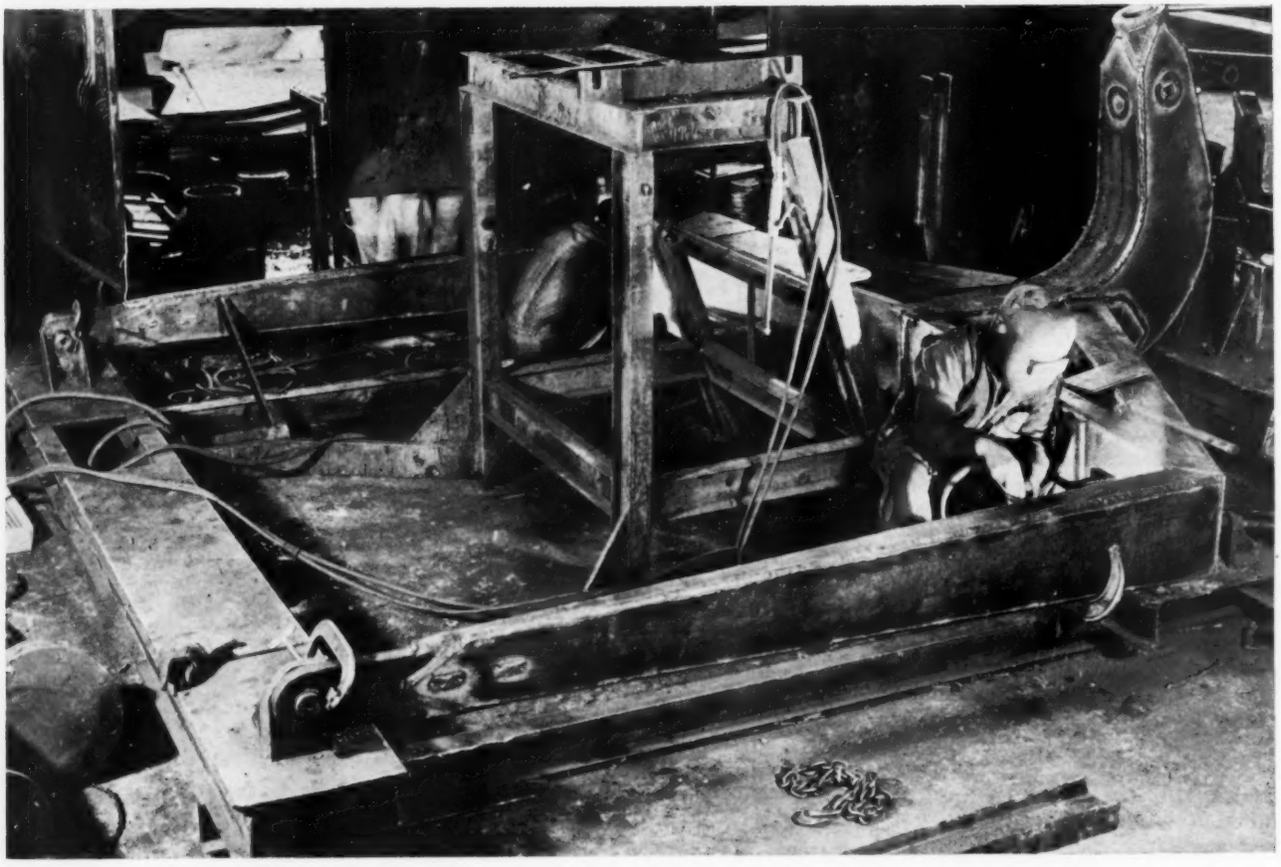
square on the edge make 90-deg. angles. Where lap joints occur and both sides are accessible, welds often are made along the edge of both sheets, that is on both sides of the assembly.

Various makes of arc welding machines are used and the units are located on beam supports between bays, well above floor level. They are out of the way of crane loads and of work in progress, yet near enough to the latter for convenience. At many stations there is equipment for two welders to work simultaneously on the same large assembly or subassembly, but in other cases a single welder works alone. There are, of course, helpers who assist in setting parts in place and in clamping or otherwise fastening them preparatory to welding.



These two welders are completing a yoke subassembly for an hydraulic scraper. In the foreground, at the end of the hinged arm, is a casting to which supporting plates with angle braces have been welded

Front lift yoke and standard assembly are held in a welding fixture while being fabricated from steel plate



Use of Special Cam Slides

BY H. A. FROMMELT, DIRECTOR OF INDUSTRIAL RESEARCH, KEARNEY & TRECKER CORPORATION

Fixtures with pivoted-beam cams change single-purpose machines into time-saving special tools

STANDARD TEXTS on machine design and cam layout make no mention of what will here be referred to as a pivoted-beam cam. One of its applications, shown in Fig. 34, is in a fixture for the contour milling of connecting rods. As the table moves longitudinally to bring the rods under the cutters, the fixture rises and falls about a pivot to mill the required surface on the rods. This so-called rise-and-fall movement is effected by a pivoted-beam cam the roller bracket for which is mounted on the milling machine knee. As the table moves longitudinally the cam roll engages the pivoted beam, thus raising or lowering the fixture about its pivot according to the design of the cam track.

The pivoted-beam cam is milled by the set-up shown in Fig. 35. A special vertical spindle, attached to the overarms of a horizontal milling machine, carries the cutter or, as in the case shown, the grinding wheel. The cam slide used is a variation of those already discussed in this series. The slide is movable but not, as in those previously described, longitudinally. The slide is pivoted to the table, leaving the slide free to move in an arc about the pivot point as a center. The radius of this arc must be equal to the radius of the arc swung by the fixture on which the cam is to be used. This is apparent from Fig. 34 in which the center of the arc is the pivot point at the right-hand end of the fixture.

When machining the cam, the roller bracket is fastened to the milling machine column and its roller slides against a dummy templet bolted to the cam slide as shown in Fig. 35. The cam track that is being milled is bolted to the cam slide just in front of the templet and in the same relative position. Moreover, the roller on the bracket and the abrasive wheel, or cutter, must be the same diameter. A fulcrum in the form of a cylinder is bolted to the milling machine table and is used in conjunction with a lever to keep the dummy templet flush against the roller. Thus as the milling machine table moves longitudinally, and as the roller slides over the templet, the rise-and-fall movements on the templet will be transmitted to the blank cam track that is being milled.

The pivoted-beam cam, milled by this means, has some interesting and novel applications. Cams can be produced for an endless parade of fixtures that transform a general-purpose machine, such as a No. 2 horizontal milling machine, into a highly specialized and single-purpose tool. Examples of such variations are shown in Figs. 36, 37, 38, 39 and 40. Obviously, the operations illustrated in these five applications of the milling machine are not used to produce cams as such. Rather the workpieces themselves are milled as though they were cams, and since the same principle, namely the cam slide is

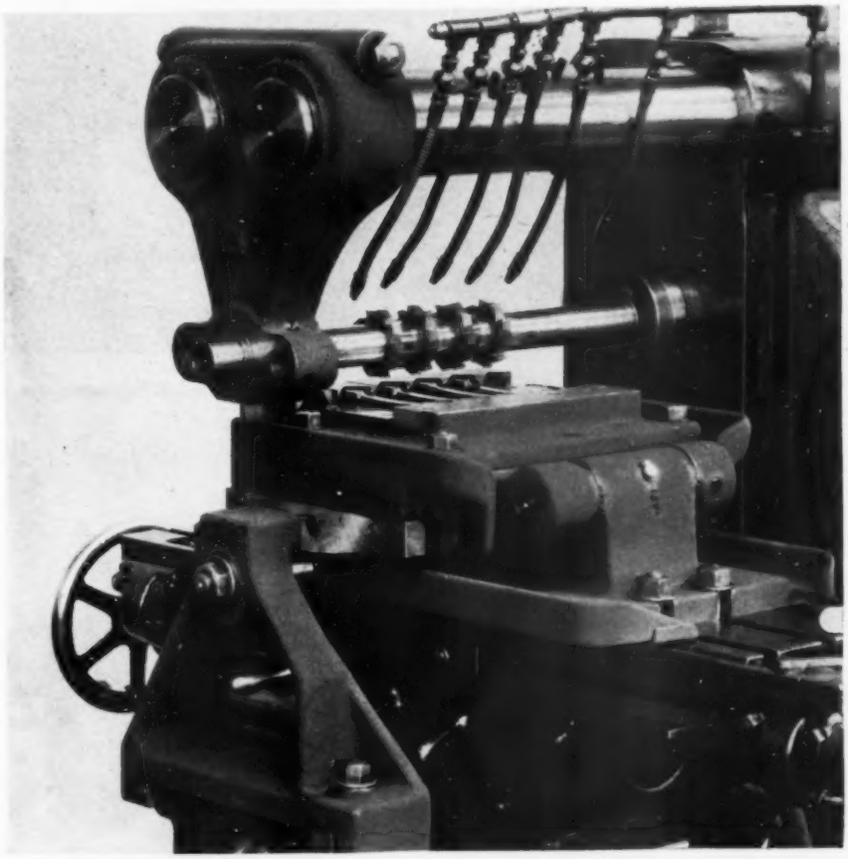
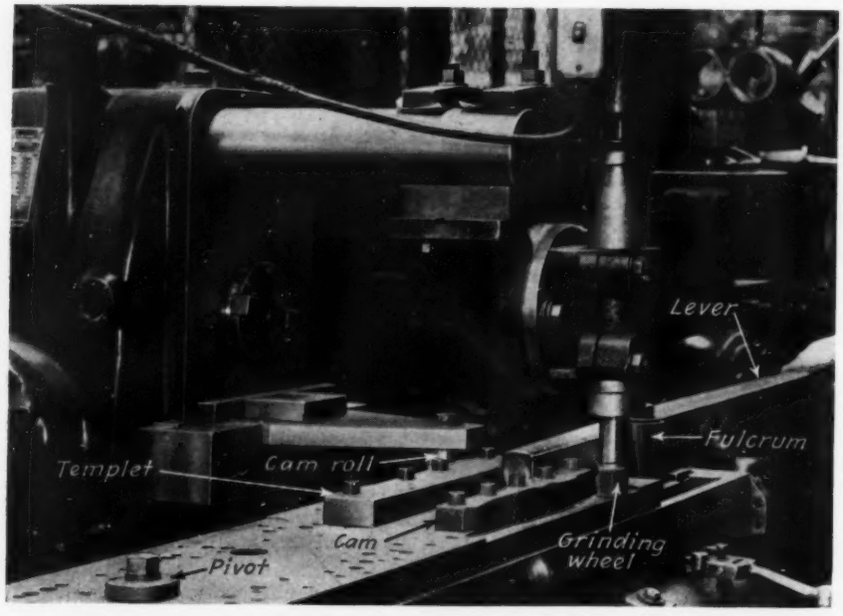


Fig. 34—This pivoted-beam cam is used to mill the contour on connecting rods. The rods are set in a pivoted fixture, the rise-and-fall movements of which are effected by the cam roll bracketed to the milling machine knee



applied, their inclusion in this series is justified.

This series on the milling of cams has divorced itself entirely from every consideration of cam design and layout. Attention was concentrated entirely on the actual production of cams in the shop.

Fig. 35—When milling a pivoted-beam cam, the cam slide is pivoted on the sub-base. The cam roll is bracketed to the machine column, while the cutter or grinding wheel is set in a vertical attachment. A lever is used to keep the cam roll flush against the dummy templet while the cam blank is being machined

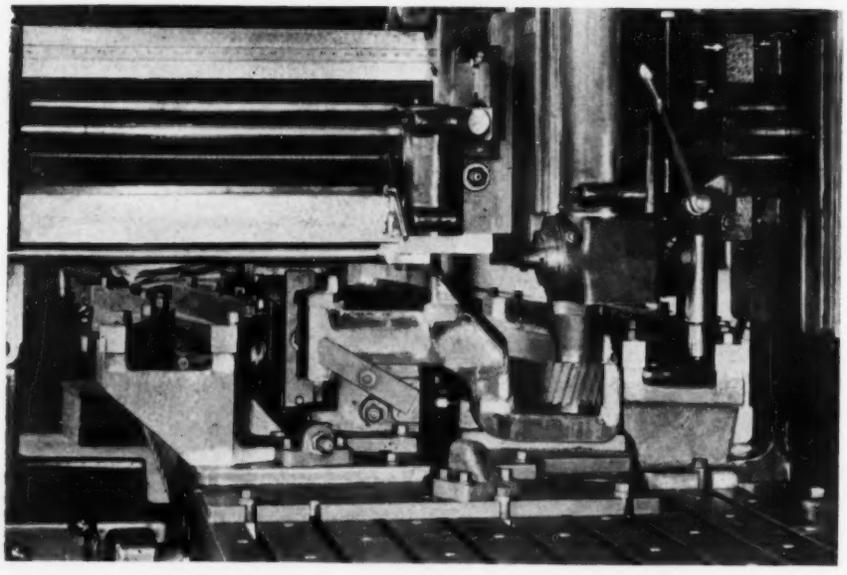


Fig. 36—The milling of an escalator track presented a problem that could be solved only by adapting the cam-slide principle to a bridge-type milling machine for which a special head was built. The head carries both the cutter and cam roll which slides along the dummy templet at the right. A rod, paralleling the rail, connects the head to an air cylinder which moves the cutter and cam roll to the right or left for machining the various faces of the track

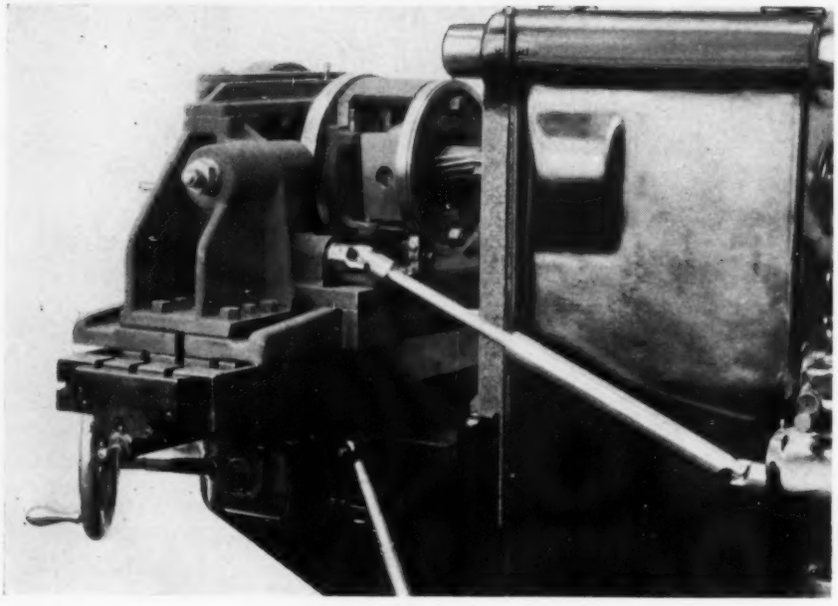


Fig. 37—The cam slide is used here to mill a pump housing. The sub-base carries the roller bracket which rides against a dummy templet mounted on the arbor that also carries the pump housing. As the arbor and housing revolve, driven by the mechanism shown, the roller transmits to the cam slide and pump housing the rise-and-fall movements laid out on the dummy templet

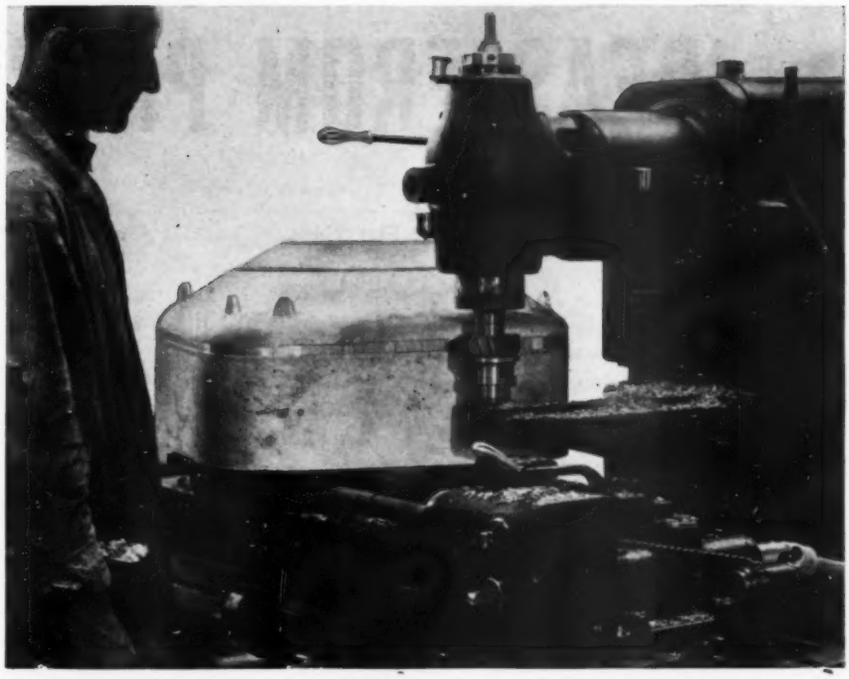


Fig. 38—In some adaptations of the cam slide, the workpiece acts as the dummy templet. In such instances, a guide roller is keyed on the spindle adjacent to the cutter and the workpiece is kept flush against the roller. Such an application is shown here in the milling of a cast aluminum washing machine tub to remove evidence of the parting line left over from the molding operation. After milling, finishing is done by replacing the milling cutter with a buff

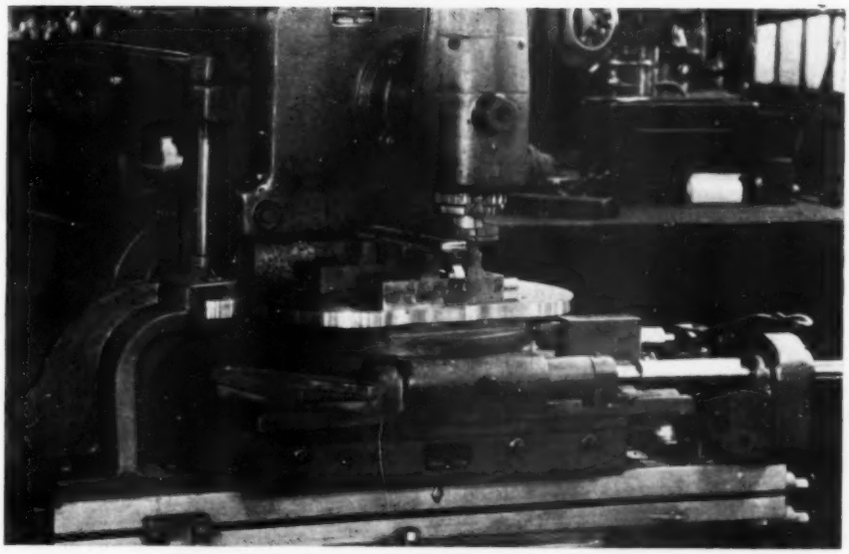


Fig. 39—Rectangles can be milled by applying the cam-slide principle. Here for example the rectangular workpiece is held above a dummy templet that revolves on a power-driven rotary table which is free to move longitudinally on the cam slide. The roller is secured to the milling machine table. As the templet revolves, its rise-and-fall movements will be transmitted through the fixed roller to the freely moving slide, thereby keeping the workpiece against the milling cutter

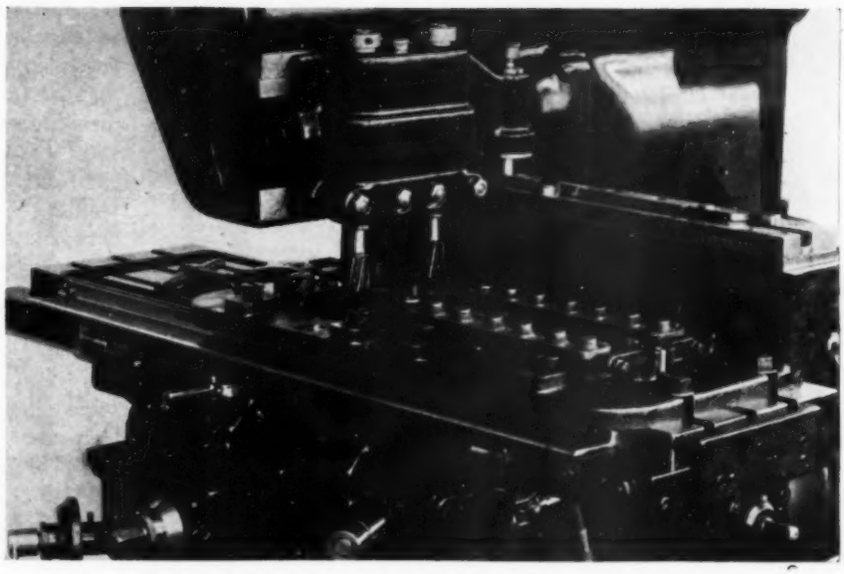


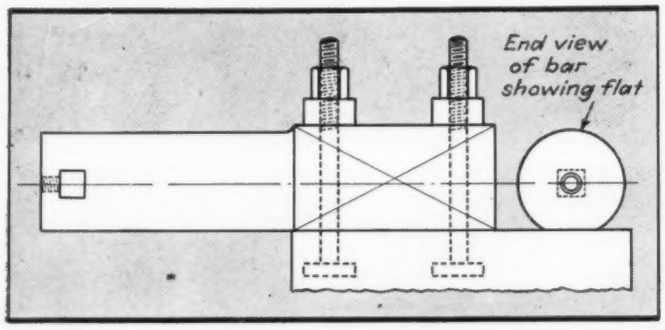
Fig. 40—In some applications of the cam slide, the cutter rather than the workpiece can be arranged to follow the cam. Such an application, shown here for milling two rectangular automobile valve-lift brackets simultaneously, involves a two-spindle head mounted so that it is free to move on the ways of a special overarm bracket. This head then becomes the cam slide. The dummy templet is above the table and between the two-spindle head and column of the machine. The cam is a switch-track dummy templet which moves the spindle head back and forth to its proper position on the ways for milling both sides of the bracket

IDEAS FROM PRACTICAL MEN

Boring Bar Clamped Against Flat Side

BY DONALD RAEBURN

Difficulty in clamping a boring bar so that it did not chatter was encountered by the writer. A boring bar 16 in. long was required and was made from a 1-in. square high-speed steel bar. This was accurately centered to insure leaving a small flat on all sides after turning off the corners to $1\frac{1}{16}$ in. dia. Despite



This heavy boring bar is machined flat on the base to permit solid clamping

the flat side, a slight chatter occurred. This defect was removed by milling $\frac{1}{32}$ in. from the base of the bar.

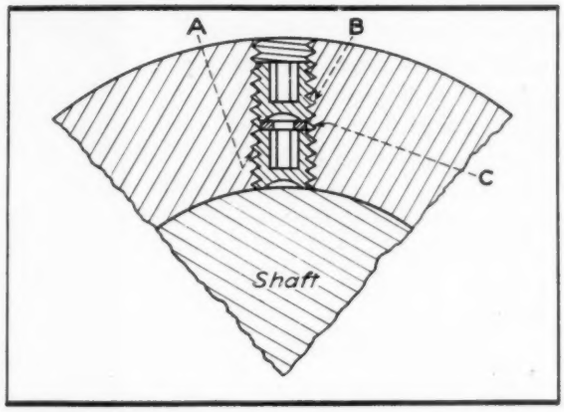
A heavier bar, 22 in. long, was made from a $2\frac{1}{2}$ in. square steel bar. This bar was machined with one flat side to fork the base of the bar. Slight chatter which occurred was cured by shaping $\frac{1}{8}$ in. from the base.

One item which is often overlooked is that, if carbide tools are used, then the base of these tools has been machined to provide a solid seat. To insert a tool bit with a machined base into a boring bar which has not had similar treatment, can hardly be considered correct. If the base of the bar has been machined and chatter occurs, then the trouble is in the machine parts and not in the tool or bar.

Washer Protects Setscrews

BY THOMAS TRAIL

Frequently when pulleys, couplings or gears are fastened to shafts, double setscrews are used. Hollow setscrew *A* is screwed tightly against the shaft and second hollow setscrew *B* is screwed tightly against the top of the first one. This is done in an effort to lock the first screw in place. However, it sometimes happens that the hardened point of the second setscrew damages the wrench opening in the first,



A small steel washer placed between two setscrews will keep the point of one from damaging the head of the other

causing difficulty in inserting a wrench in the wrench opening.

One solution to this difficulty is to place small, suitably sized ordinary steel washer *C* between the two setscrews, as shown in the drawing. The soft metal washer will prevent damage to the wrench opening of the first setscrew.

Automatic Screw Bushing Saves Time

BY F. J. YUNKER

Tool Department, General Electric Company

Some time ago we were confronted with the problem of locating a 0.134 in. dia. hole concentric with a $\frac{3}{8}$ in.-24 tapped hole. The reason for the extreme accuracy in alignment of this hole with the tapped hole is that when a purging screw is assembled to the part, or valve body, it is necessary that the point of the purging screw entering the hole form a perfect seal.

After abandoning the hope of getting the accuracy required on these parts from the screw machine department, it was decided that an additional redrilling operation would be necessary. This was, at first, accomplished by the use of a screw bushing which was manually screwed into the valve body thus making a suitable guide for the drill. This method produced a satisfactory quality job but too much time was consumed in screwing the bushing into the work and then unscrewing it after the hole has been redrilled.

To overcome this loss of time an "Automatic Screw Bushing" was developed which, with the assistance of a tapping head would automatically screw the bushing into the work, redrill the hole, and then

unscrew the bushing by the mere lowering and raising of the spindle of the drilling machine.

Work, *W*, in the drawing, as received from the screw machine department, has the $\frac{3}{8}$ in.-24 hole already tapped and a 0.128 in. dia. hole drilled through, leaving sufficient material for redrilling. The work is mounted on a suitable fixture (not shown) to locate the work under the spindle of the drilling machine.

To the quill of the drill machine is mounted a tapping head. Adapter *A* and collet drill holder *B* are mounted and taper-pinned to the spindle of the tapping head. Into the collet is inserted 0.135 dia. drill *C*.

Body *D* of the tool is bored on the top end to fit adapter *A*. It is also drilled and tapped for set screw *E* and slotted for key *F*. The bottom end of the body is bored to receive end thrust bearing *G*, compression spring *H*, ring *I*, and guide bushing *J*. The outside diameter at this end is turned and threaded for retaining nut *K*. It also has three large openings milled through the side wall through which the chips are automatically ejected from the tool by centrifugal force.

Guide bushing *J* is made of hardened tool steel and serves as a guide for the 0.134 dia. drill. It has a 45-deg. ground surface to match the 45-deg. surface on nut *K*. These two surfaces form a friction clutch between guide bushing *J* and nut *K*.

The recess on the top side of the guide bushing is for the purpose of utilizing another $\frac{1}{2}$ in. of the drill. Ring *I* prevents chips from working their way to the 45-deg. friction surfaces and at the same time guides the chips to the openings in the body.

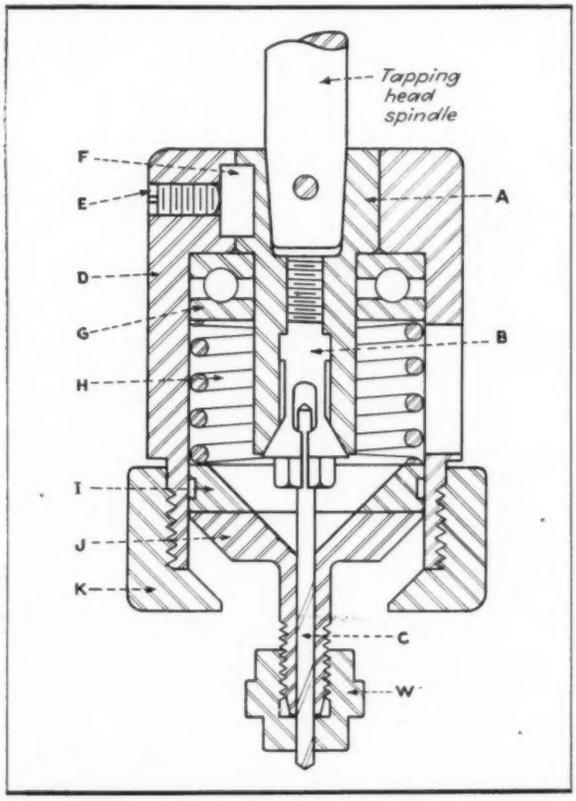
Retaining nut *K* holds the complete assembly together and acts as a friction drive for bushing *J*.

In operation it will be noted that the assembled tool is fastened to the spindle of the tapping head which runs in the reversed direction to drilling when no pressure is applied. As soon as the drill spindle is lowered and the drill bushing comes in contact with the work, the tapping head immediately reverses its direction of rotation to right hand and screws the bushing into the work through the friction drive between the 45-deg. surfaces on the retaining nut and the guide bushing. The guide bushing continues its travel until it bottoms against the shoulder in the work, at which time the friction between the bushing and the retaining nut is broken. As the spindle of the drilling machine is further lowered, the drill continues its travel and performs the necessary redrilling operation.

After the drill has completed its work the operator raises the spindle of the drill machine. When it has been raised sufficiently high so that the 45-deg. surfaces of nut *K* and bushing *J* have again made contact, the upward thrust against the spindle of the tapping head produced by compression spring *H* is released allowing the spindle of the head to drop slightly. This dropping of the tapping and spindle immediately throws the direction of rotation into reverse again. It is through this reverse direction of rotation and the raising of the drill spindle that a friction clutch between the retaining nut and the guide bushing is again formed, causing the guide bushing to unscrew itself from the work.

In order to change drills it is only necessary to loosen setscrew *E* and remove body *D* with its parts assembled in one unit. This makes the drill collet accessible, and the drill easily changed. The assembled body is then again put back in place and secured by setscrew *E*.

A time study of the performance of this tool as compared with the previous method used would be of interest. Records show that the past method allowed 0.151 min. for manually screwing the bushing into the work, 0.080 min. for actual drilling time, and 0.125 min. for removing the bushing, or a total of 0.356 min. With the present method the first and third operations are eliminated and the time study shows an allowance of 0.080 min. for the operation. From these figures it can easily be seen that a time saving of more than 75 percent has been realized.

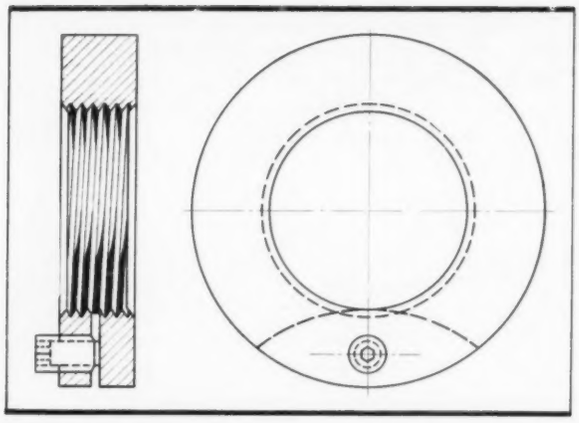


For redrilling the hole in work W, this attachment automatically screws the bushing into the work, redrills the hole, and unscrews the bushing

Positive Lock for Threaded Collars

BY PAUL GRODZINSKI

A method for locking a threaded collar in position without marring the threads was explained by L. Kasper (*AM*—Vol. 85, page 1144). This method used a circumferential saw cut to leave a tongue on the



This threaded collar is radially slotted and equipped with a thumb screw so that it can be locked in position on the threaded column

inside of the collar to tighten against the threaded column.

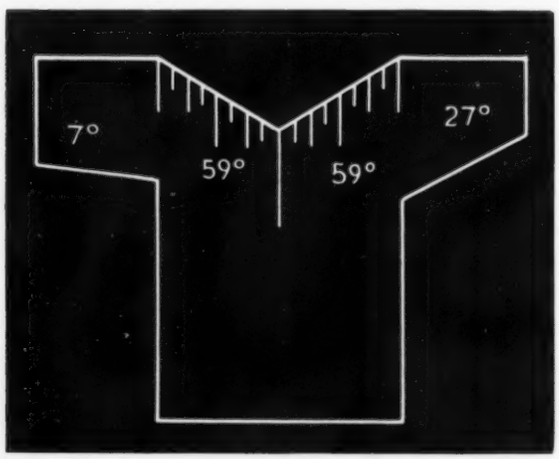
As an alternative method, I have used a design in which the ring was tangentially slotted and a clamping screw applied, so as to spread the separated halves. The spring action of the untouched part will bring the halves into the original position, after release of the screw pressure. This solution can be used for very small size nuts in which the other type of slot would be difficult to handle.

Gage Checks Tool Bits

BY MARTIN H. BALL

While all cutters for machine tools can best be ground on equipment made especially for that work, there are emergencies when machine tool operators need to grind tool bits and twist drills by hand, especially in the smaller shops.

To better meet these latter conditions and to assist in securing suitable cutting edges with proper angles,



Made from 1/16 in. sheet steel, this gage is made with the angles most commonly used in grinding tool bits and twist drills

the gage for grinding tool bits and drills shown in the drawing was made of $\frac{1}{16}$-in. sheet tool steel.

As the most common relief angle used for tool bits is 7 deg., the 7 deg. angle is used on the side and the top of bits, while the 27 deg. angle is used on the end of the bit due to the 20 deg. angle which is used in the tool holder, thus leaving a 7 deg. angle for the bit in relation to the work. Of course the gage could be made with other angles as desired.

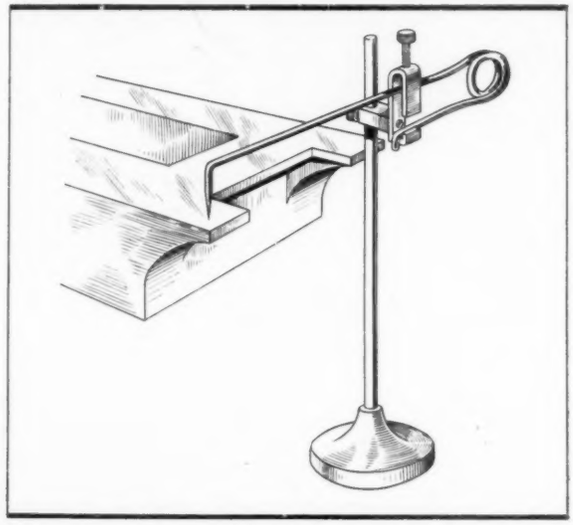
The 59 deg. angle from the center line is used with its graduations to test the angle and even length of lips on twist drills.

Attachment Holds Punch Holder

BY S. BALDWIN

A special chuck or adapter which is threaded on to the lathe spindle nose and extends far enough to be honed out for a slip fit for punch holder shanks is a big help when there is machining to be done on the under side of the punch holder.

Such a tool is better than a universal chuck for scribing a circle on the underside of a punch holder to correspond with the circumference of the shank thus helping to locate screw and dowel holes so as to avoid making half round holes in the side of the punch holder shank.



This gage is easily constructed from material which should be available in any shop

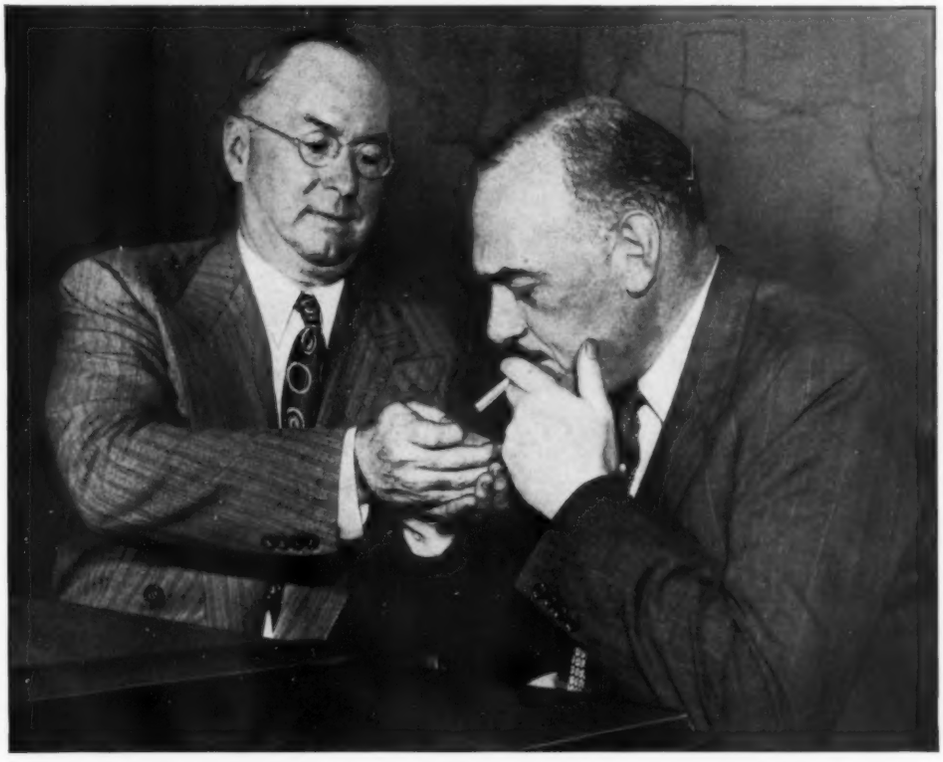
Simple Surface Gage

BY C. H. WILLEY

The simple tool for indicating surfaces shown in the drawing can be made from easily available material and requires very little machine work.

A vertical rod is mounted on a base. The indicator frame is free to slide up and down the rod and can be clamped in place by tightening a knurled hand screw. A spring wire is attached to the yoke and rests against an adjusting hand screw at the top of the yoke.

The Story That Must Be Told



Two men who know the story best: Donald Nelson, Chief of the U. S. War Production Board, and (right) Oliver Lyttelton, Great Britain's Minister of Production.

BETWEEN THE LINES of today's war news is written a story that is even more vital than the news itself. For through that story we begin to discern the pattern of victory, not yet complete in all its details but increasingly clear in its essentials.

It is the amazing story of how American industry has responded to the call for the weapons of total war, of how its technicians, workers, and managers are driving through an unprecedented task of fantastic size and complexity.

France fell in June 1940. During that month this country produced about $150,000,000 in war goods. By June 1941 the Nazis had overrun the Balkans; and in that month our war production was $800,000,000. The fateful month of December 1941 gave us an output of $1,800,000,000—an increase better than tenfold in eighteen months. And in May 1942 our total expenditures for war equipment and supplies mounted to the staggering total of $3,500,000,000.

This is an increase of twentyfold within two years, of itself a stupendous industrial achievement. But what is even more important, that achievement already is making itself felt the world over—in the Orient, in Australia, in Libya, in Europe, in the Coral Sea, at Midway Island, at the Aleutians, and wherever else we find a battlefront manned by free men.

To accomplish it, many industries have been pouring out war materials at a rate that only six months ago did not seem even remotely possible. Starting from scratch, our factories have turned from their peacetime jobs, first to meet and then to surpass the most hopeful estimates of what might be expected of them.

To do this they have drawn heavily upon all of their resources. Their skilled and unskilled

man-power has thrown into the task a war-born will to work; their research staffs have bent to it all of their scientific resources; their engineers have applied to it their utmost ingenuity; their executives have devoted to it the full measure of that managerial skill which has won for American industry the respect of the modern world.

For the first time in history we have pushed the accelerator of the world's greatest engine of mass production down to the floorboard. Always in times of peace, factory men have had to gear production to what the markets would take. But now the market they are called upon to serve is hungry for the last ounce of potential output. For war confronts industry with a demand limited only by its capacity to produce.

During these feverish months, while a desperate world has watched breathlessly to see how American industry would perform as the arsenal of democracy, we of McGraw-Hill have followed with mounting pride — at times almost with wonder — a new miracle of industrial achievement.

Some day the full story of this American industrial effort will fill a brilliant chapter in the epic history of our times. Meanwhile it would be premature to celebrate the completion of this task. For victory has not yet been won; that still lies at the far end of a road that we may find to be long and arduous.

But even now we can be certain of one essential of that victory. American industry is doing its job; it is delivering all that the people have asked of it — and more.

As I have watched with my associates the unfolding of this picture, I have wished that it were possible to broadcast it, in full color and wealth of detail, to the people of America, so that they could understand at least, in part, the job their industry is doing for them. It would help, it seemed to me, if the men of industry themselves, each so intent on his own task, knew what their fellow-workers in other fields have been doing.

However, the managers of industry have been far too busy ***doing*** to talk. They are going to be just as busy for some time to come. Naturally, many details are yet to be spread upon the record and, indeed, the full story cannot be told. But that part of the story that can be told is well worth the telling and the hearing, if only for its revelation of the spirit of an awakened America, throwing its all into the fight against the tyranny that has brought so many of the world's little people under its heel.

The 1941 war production of the United Nations, exclusive of the United States, equalled the total 1941 war output of Germany with all of its captive plants and enslaved labor. Since Germany's 1941 operations were at maximum capacity no further increase is possible. British output has been expanding to the point where its 1942 production is considerably ahead of Germany's.

In May 1942 American war production passed the British output 50 days ahead of schedule. In 1943 it will be 3 times that of the British.

This has been brought about under the leadership of Donald Nelson and the War Production Board, the Army, the Navy, the Maritime Commission, with the cooperation of management and labor. It has been furthered by the cooperation of Oliver Lyttelton, British Minister of Production, and other British production authorities.

But the story goes far beyond that. It gives us a glimpse of the America as it will emerge from this war, its industries again setting world standards of production, which will become the spearhead of our post-war economy.

This is a story that cannot be adequately told in generalities. It must be told in some detail. For instance, the great accomplishments of the machine tool industry, the great forward strides made by the aviation industry, the tremendous achievements of the chemical industry, the amazing conversion of many industries will warm the hearts of Americans.

These aspects of the subject deserve the fullest treatment and will be told month by month in these pages until the story has been completely unfolded. We will try to give a concise overall picture of the war job that industry has done and still is doing. You will find it a thoroughly American story of high American achievement in which every American can take pride and from which every American can take hope for the future of his country.

The story is far too significant to be withheld any longer.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

Armament

SECTION OF AMERICAN MACHINIST

Cannon for Aircraft

Besides keeping careful records of firing tests on each gun, every cannon is given a preliminary cleaning after firing, is completely disassembled for checking of all parts, and finally assembled for shipment

International Harvester Company exceeds production schedule without the aid of special machines. Standard machine tools are used for 95 percent of the milling, drilling, reaming, rifling and grinding operations on major parts of a 20-mm. gun

IN THE MANUFACTURE of 20-mm. automatic airplane cannon for U. S. Army fighter planes, the International Harvester Company, at a works "somewhere in the middle west," is more than two months ahead of contract schedule. On the thirteenth day of a recent month, a year to a day from the time when this company had started to convert a warehouse into a war production plant for making these guns, it had attained that rate. This it did chiefly with the use of standard equipment from the machine tool manufacturers. Very few of the machines it is using for the broaching, drilling, rifling, milling, grinding, and other operations on the four main sub-assemblies of this gun—the tube or barrel, breech block, the bolt, and the lock—are special. Although appropriately

These articles have been reviewed and approved by the proper military authorities

MAJOR OPERATIONS ON THE BARREL
Saw to length - Center both ends
70 3/32"
Plunge grind two spots for steadyrests
Steady rest
Semi-finish turn outside diameter
Steady rest
Grind three spots for steadyrests
Drill barrel hole to 19 mm. Pull ream bore to 19.6, 19.8 and 19.96 mm. Hone to 20 mm.
Rifle nine grooves in barrel
Grind thread diameters, breech end and nozzle end of barrel
Hob 42 splines
Full depth of spline for this length
Mill threads at breech end

equipped with cutting tools, jigs, and fixtures, over 95 percent of these machines are standard.

But the making of this gun is not simple. In its demands for precision production it is one of the most intricate. In its use for winning the war it is one of the most important. It is a cannon of 0.781-in. caliber and with the longitudinal sliding type of breech block. Its over-all length from muzzle to rear face of the receiver body is 100.75 in. and the length of the barrel is 67.52 in. Finished, it weighs 112.6 lb. It shoots at the rate of 600 rounds a minute. Four of these guns are mounted on the wings of a U. S. Army fighter plane, two in each wing, all four pointed ahead to the line of flight of this highly maneuverable plane. The pilot cocks or charges the gun hydraulically or pneumatically, and touches off the gun-lock trigger electrically to explode the first round. Gas from that and succeeding explosions extracts empty shells and drops new ones into the gun chamber—and an enemy plane gets sprayed at the rate of 2,400 slugs within a minute. The shells are $7\frac{1}{4}$ in. long and the projectiles of 20 mm. diameter are 3 in. long.

This gun is one of the kind which Seversky, in his book "Victory Through Air Power," declares to be what gave England superiority in quality of planes including fire power, in the face of Germany's superiority in quantity of planes during the "Battle of Britain." It is the American and British improvement on the Hispano-Suiza cannon, much exhibited during past years in Europe. Probably there is no weapon of greater importance among those which America's metal-working industries are now turning out in the battle against time on the war production front.

An Eye to the Future

In the purchase of $3,500,000 worth of new equipment on behalf of the government for manufacturing the 20-mm. gun, the company producing it had two purposes. These were definite. One was to get into production as quickly as possible. The other was to have the maximum amount of equipment which after the war could be used, as is or retooled, for civilian production.

A study of the operations being carried out in Harvester's manufacture of this gun shows there are several reasons why this policy of using standard equipment has proved successful. The fundamental one, of course, is the high development of metal-work-

Fig. 1—The barrel of 20-mm. automatic cannon is turned from bar stock. Ten of the major machining operations are shown here. Details of the drill, reamers and broaches for finishing the bore are shown in Figs. 2, 3 and 4, respectively

CANNON FOR AIRCRAFT

Bar stock for the barrel of the 20-mm. cannon is sawed to length and centered in this Sundstrand machine. Two spots are ground on the barrel for steadyrests used when turning the outside diameter

ing machines by the various manufacturers in the machine tool industry, including the development of standard machines for manufacturing guns. To take advantage of this, and to speed deliveries, Harvester in many cases during the equipping of the 20-mm. gun plant divided its orders for a given class of machines between two or more machine tool manufacturers.

Another reason was that at the outset in getting organized and in its trial production, this gun works could and did call on some of the fourteen other Harvester works for the loan of machines, as well as for management men skilled in organizing, training, production and inspection. A further reason was the high standard and cooperative attitude of inspectors and others from the Chicago Ordnance District of the Army and from the Arsenal at Watervliet, N. Y. Still another vital reason was the intensive training program adopted and carried out for developing skill by new employees inexperienced in machine work, girls as well as men. All this could have failed, however, had there not been outstanding work by engineers in tooling up the standard machines, and by the works management, not only in over-all organization and in intensive follow up, but in establishing, equipping and running an efficient toolroom.

Above these factors too is a special spur from the fact that three other companies, at widely scattered manufacturing points "somewhere in the United States," and also the British, with an unknown number of manufacturers at it, are making the same gun. This is no sentimental spur. It is very tangible. For even though Harvester inspection includes the actual firing of every one of the guns it produces, Harvester and each of the other three American producing companies, once each month send two of their guns to the Watervliet Arsenal. Each part of those guns sent by International Harvester is marked, as is every part of its production, with the "IHC" monogram. The same is true of the others. And the parts from Harvester and the other three war production companies must be perfectly interchangeable.

Besides producing a stipulated number of assembled guns for shipment to an Ordnance Department Depot each month, the Harvester contract calls for 10 percent additional of unassembled parts. Every part must be a snug fit for use in the air over the seven seas and over any continent.

The tolerances are close. Some are 0 to 0.002 in. Some are from 0 to 0.00025 in.

In all there are 126 different parts in this 20-mm. cannon. Thirteen of these are made in the Harvester works devoted to producing the gun; the balance comes from other plants of the company and from subcontractors. Not only Harvester people but also Chicago Ordnance District officers take justifiable pride in the fact that twenty-four subcontractors are suppliers to this Harvester gun plant for the production of 20-mm. cannon.

Shown in the Figs. 1, 5 and 7 are the major machining operations on three of the four hardest parts to manufacture, the four most important subassemblies. They are: (1) The tube or barrel, (2) receiver body or breech block, (3) bolt, and (4) lock.

The outside diameter of the cannon barrels are first rough and then finish turned on automatic Seneca Falls Lo-Swing lathes. Seven cam-actuated carbide-tipped tools are used in the roughing operation

A battery of eight LeBlond No. 2 gun drilling machines is used to drill the barrel hole, which is then reamed in successive steps to 19.6, 19.8 and 19.96 mm. Reaming is done on a battery of ten No. 2 LeBlond machines

All told they involve 224 operations, mostly machining. These are divided as follows: Tube or barrel, 33; breech block, 85; bolt, 52; and lock, 54.

The machines in the barrel and breech-block departments are operated exclusively by men. Those in the bolt and lock departments, which also make many small parts that go into the subassemblies, are operated chiefly by girls. There is a set-up man and one or more girls for each machine or group of machines in these two departments. Broaching, grinding, and turret-lathe work, as well as milling, are among the operations performed by these girls. Of the total force of employees, about 37 percent is women.

The women machine operators wear maroon uniforms,—caps, blouses and slacks of that color. The caps are on the order of Army officer's caps, with visors, but the crowns of the caps are much larger—large enough in fact to protect the most luxuriant head of hair completely.

The materials of which the 20-mm. gun is made are high quality steels. The specifications provide that

most of the parts shall be WD4340 or WD4640, the tube heat-treated to 269-321 Brinell, the bolt heat-treated to 350-380 Brinell, the breech to 270-300 Brinell. The lock is hardened to Rockwell 79-84C.

The barrels come in as bar stock, rough turned, each weighing 83 lbs. The breech blocks come in from another Harvester plant, as forgings, each 77 lb. in weight.

There is provision for heat-treating the barrels on the first floor of the plant, not far from the receiving platform adjacent to the railroad switch track. Heat-treating equipment includes sunken furnaces into which the barrels are inserted vertically. All the other heat-treating takes place at a battery of ovens and quenching tanks, some with specially designed protective covers. These are on the second floor of the plant.

Barrel is Rifled by Broaching

After the long bar stock for the barrel has been strain annealed, it is sawed to a length of 70 3/32 in. and centered in a Sundstrand centering machine. The original set-up was to mill the ends, but it was found that they could be cut off more quickly with a segmental saw. The other preliminary is to grind two spots for steadyrests while finish turning. This is performed on a 10x72-in. Landis grinder. These and succeeding major machining operations are shown in Fig. 1.

The outside diameter is semi-finished on a Seneca Falls 8-in. Lo-Swing lathe; in fact, there are three of these machines kept going on turning barrels. On each there are seven carbide-tipped tools, actuated on the cam.

Preparatory to drilling and reaming the gun bore, three spots for steadyrests are ground on the barrel as shown in Fig. 1. Drilling and reaming operations on the barrel are performed on a battery of eight Le Blond No. 2 gun drilling machines, and a battery of ten Le Blond No. 2 gun reaming machines. The tools used on these machines are shown in Figs. 2 and 3. Reaming is done in three passes. These machines are operated hydraulically. Drilling speed is 1,040

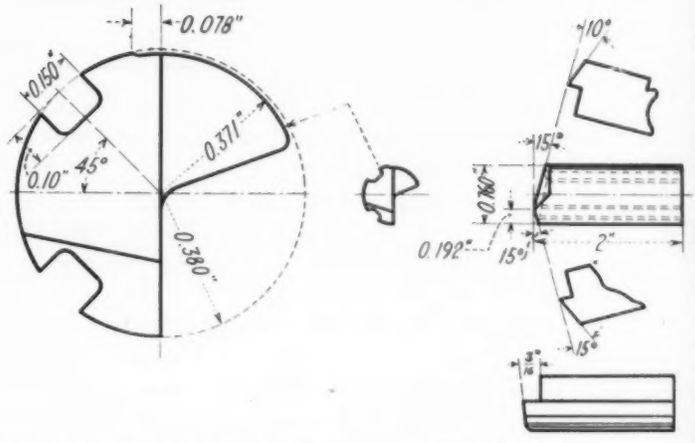


Fig. 2—Shape and angles of cemented-carbide drill tip used for the first operation on the bore of the 20-mm. cannon are shown above. The hole is drilled to 19-mm. diameter

r.p.m. and the feed is 0.001 in. per revolution; in this operation it is the work, not the drill, that turns. The shanks of the drills are hollow. Cemented carbide drill tips are used. The drill and shank have a V-groove for chips, forced out by coolant at a pressure of 500 lb. per sq. in.

Drilling and reaming are followed by some finish-turning and grinding. Each barrel is then inspected and checked, using a special Magnaflux machine that holds and revolves the barrel while examining it for cracks.

The facing of the breech end and the boring and reaming of the cartridge chamber, and related steps, soon follow. The operations involved are performed on a Gisholt turret lathe, using a profile cam, and a series of tools. There are four of these machines in the battery. Each rough bores, rough reams and finish reams the barrel leaving 0.010 in. for the finish grind, and at the same time roughs the face of the breech end.

The rifling of the barrels is done by broaching on two batteries of broaching machines—one American and one LeBlond. These machines are approximately 26 ft. long. The rifling grooves are obtained by use of a leadscrew on the machine. This screw is 2½ in. diameter and approximately 13 ft. long on the Ameri-

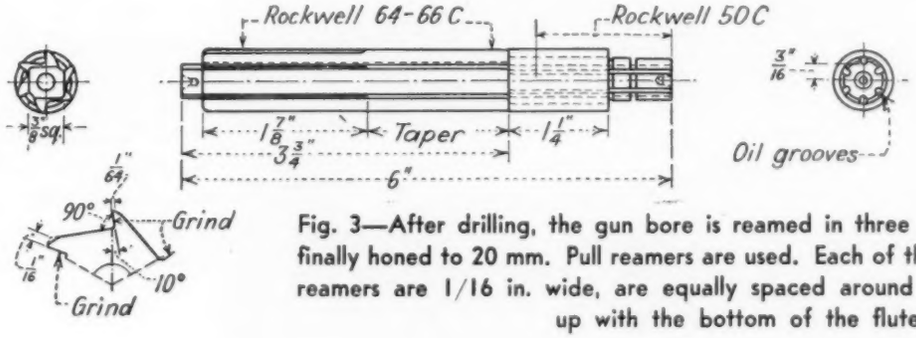


Fig. 3—After drilling, the gun bore is reamed in three steps to 19.96 mm. and finally honed to 20 mm. Pull reamers are used. Each of the six oil grooves in these reamers are 1/16 in. wide, are equally spaced around the periphery, and line up with the bottom of the flutes

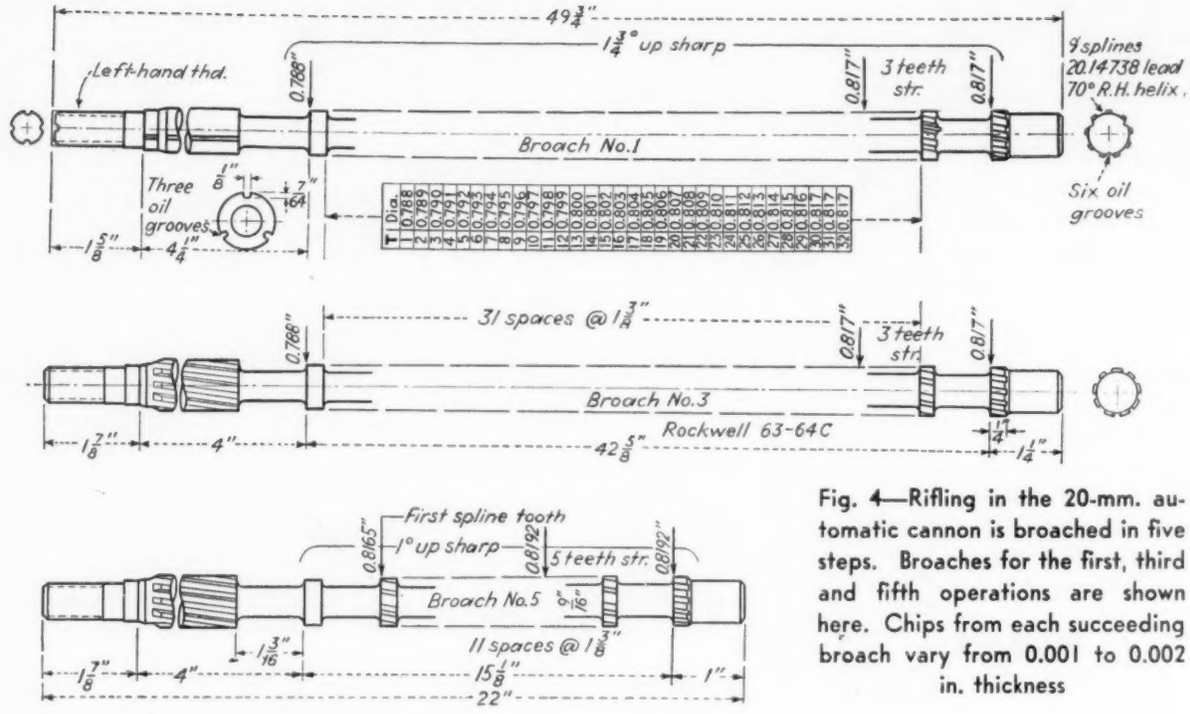


Fig. 4—Rifling in the 20-mm. automatic cannon is broached in five steps. Broaches for the first, third and fifth operations are shown here. Chips from each succeeding broach vary from 0.001 to 0.002 in. thickness

can, and 2 in. diameter and 12 ft. long on the LeBlond. A LeBlond groove lapper also comes into play to knock off burrs after rifling. The broaches used for rifling the barrels are shown in Fig. 4.

Grinding is of supreme importance to attain the close tolerances required. Various Landis and Heald grinders are used.

Drilling gas holes in the chamber and milling the extractor slot are operations requiring special attention. For the latter there is one of the very few special machines on the job, a H. R. Krueger & Company two-way drilling machine which locates and drills two holes 180 deg. apart.

For milling threads on the breech end, and also threads on the muzzle end, Coulter thread millers are used. The thread on the breech end of the barrel is held to a very close tolerance, so that when it is screwed into the breech block there will be a snug fit. After all this fine work on the machines, there is but very little hand work to put the barrel in condition for final assembly. As a result of heat-treating technique and the accuracy in machining the gun barrel, it has been possible to eliminate the straightening operation that is a common practice in the manufacture of gun barrels. This achievement at Harvester is outstanding.

Breech Block Is Milled and Ground

The breech block is finished in 85 operations, mostly milling and grinding. The important ones are shown

Broaching is a conspicuous feature of methods developed for rifling the barrel and finishing holes in the breech block. The American and Le Blond machines used for rifling the barrels have master lead bars which produce rifling grooves of constant helix

in Fig. 5. The breech block, starting as a forging about 2 ft. long and 5 in. square, is moved from machine to machine on a Matthews roller conveyor, the forging being set in wooden pallets to prevent scratching.

The first milling operations, rough milling the top and bottom, and milling a flat spot on the cylinder, provide locating points for subsequent operations. They are performed on Cincinnati duplex hydraulic milling machines. Two breech blocks are put through this machine at one time, and while it is milling the top of one it is milling the bottom of the other—the same is true of the ends and sides of the block.

A few stations along the line, a battery of four tracer control Cincinnati millers performs a series of rough profiling and rough milling operations.

The first drilling operation on the breech block is rather striking—this is the rough drilling of a $1\frac{3}{4}$-in. hole 3 in. deep in the end of the block into which the barrel is ultimately screwed. This is done on a Baker vertical drill press with the block held rigidly in a fixture. Moreover it is done without first drilling a small pilot hole.

After rough straddle milling on an Ohio mill to form a radius, and rough milling between ribs on the upper rear face of the breech block on a Sundstrand Rigidmil, the block is heat-treated before coming back to the line for further drilling, milling and grinding.

For rough and finish drilling a $23\frac{7}{8}$-in. long hole, which is later reamed to 1.181 in. diameter, three Natco horizontal deep-hole drilling machines are used. In these the drill remains stationary and the work turns on a counterbalanced fixture which was designed for Harvester by Natco. One man handles three machines—drilling on two and reaming on one. Details of the drill and reamer used in these operations are shown in Fig. 6.

Broaching of the 1.181-in. bore, the next operation, is done in six passes with specially designed broaches on an American horizontal broaching machine. The broaches are pulled through one at a time in a floor-to-floor time of 12 min. The coolant used is soluble oil.

A tracer control Cincinnati duplex milling machine, with a gang of four cutters on each piece and a plug for locating, is used to profile mill the sides and angles of the breech block.

Grinding is an important part of the finishing operation on this gun, necessarily so for it is a precision instrument. Many of these operations are performed on surface grinders—others on grinders with magnetic chucks to speed the set-up. Dimensions are checked by gages built into the machines.

Two of the few special machines used by Harvester in the manufacture of this gun are a Natco horizontal combination driller and tapper, and a Natco vertical driller with forty spindles. Both use an indexing fixture having six stations. Natco and United States Drill Head Company cooperated in building the 40-spindle head for the vertical machine. Among the operations between those on these two special machines is the broaching of loading slide grooves in the block, using an American vertical broach.

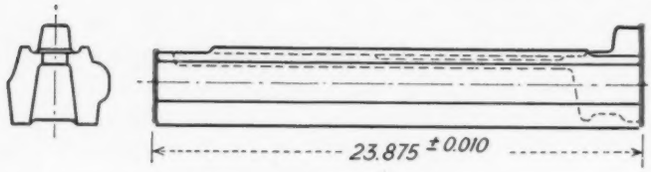
When final holes have been drilled in the breech block and it has been washed, it is hand finished. This is done by a group of fourteen men at benches who burr, grind, file and polish all corners and ground surfaces.

Operations on the Bolt and Lock

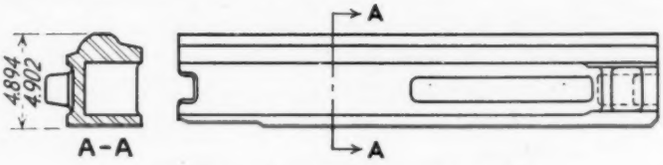
The operations on the small pieces of the bolt mechanism, the functions of which include extraction of shells, are such as to benefit from the delicate touch of women's fingers. Besides milling and grinding operations, the important ones of which are shown in

The diametral taper and 30-deg. angle of the cartridge chamber in the barrel are ground to final dimensions. Both of these high-precision operations are completed quickly on this Heald grinder

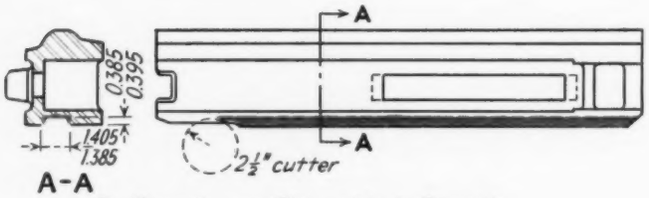
MAJOR OPERATIONS ON THE BREECH BLOCK



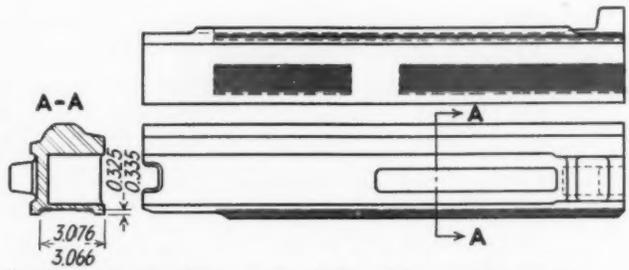
1—Rough mill ends



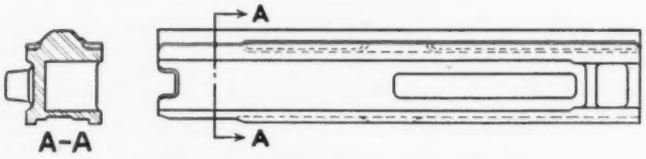
2—Rough profile outer edge



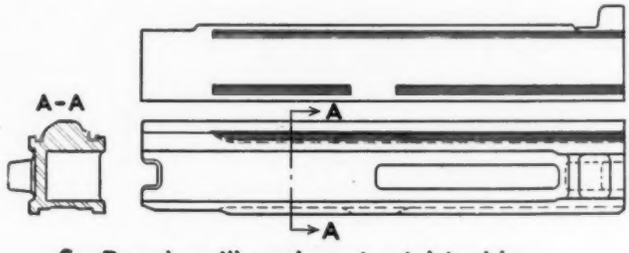
3—Rough profile mill, left side



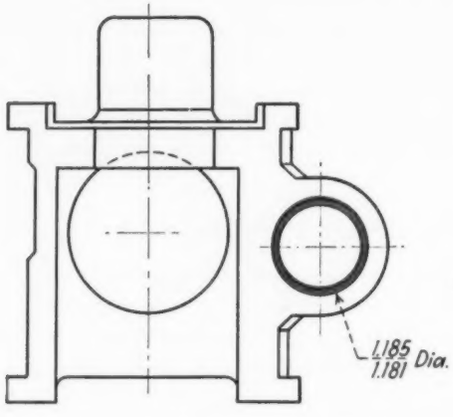
4—Rough profile mill, left side undercuts



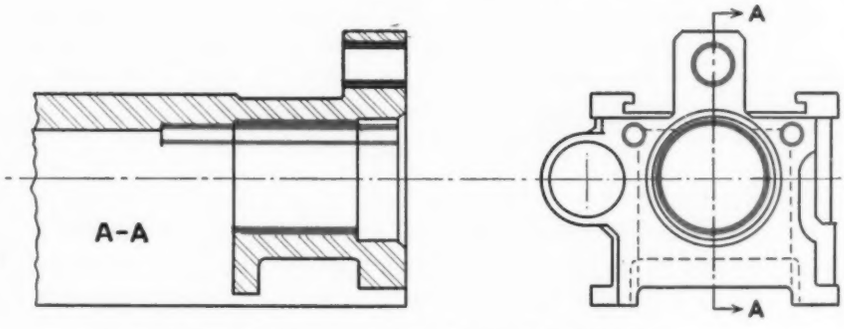
5—Rough mill edges, right side



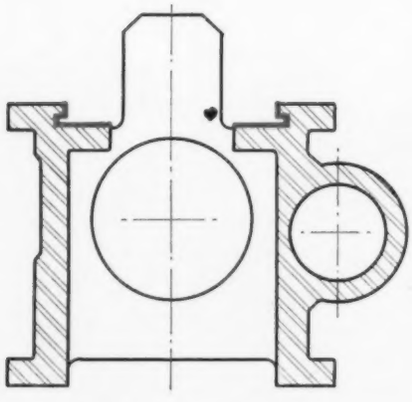
6—Rough mill undercut, right side



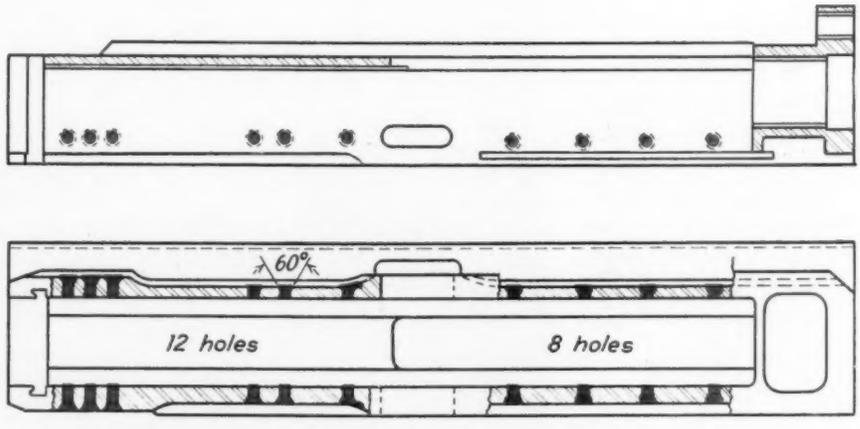
7—Drill, ream and broach 1.185" hole



8—Drill, bore, ream and tap four holes



9—Rough broach slide grooves



10—Drill, countersink and ream 20 holes

Fig. 5—The breech block or receiver body for the 20-mm. cannon is machined from a solid forging. There are 85 individual operations performed on it, the major ones of which are shown here

The production line for the breech blocks begins with milling the ends of the forging. The blocks then move from machine to machine on a Matthews conveyor, wooden pallets being used to avoid injury to the machined surfaces

Fig. 7, the bolt is turned, faced, drilled and reamed on No. 3 Jones & Lamson turret lathes. The tooling set-ups for the latter operations are shown in Fig. 8. Carbide-tipped tools are used for many of the operations, all of which are highly important because of the function of this portion of the cannon. For example, boring a hole in the bolt for the firing pin—this is first rough drilled, then heat-treated, then finished. This work is being done by women.

Broaches used for other finishing operations on the bolt are also operated by women. One such operation is the machining of 1.573-in. slot, using an American hydraulic broach. In the earlier manufacturing of the 20-mm. gun, the slot in the bolt was milled and filed. But as the job developed it was found adaptable for broaching. This broach is kept busy. It is operated in turn by three girls, one on each shift.

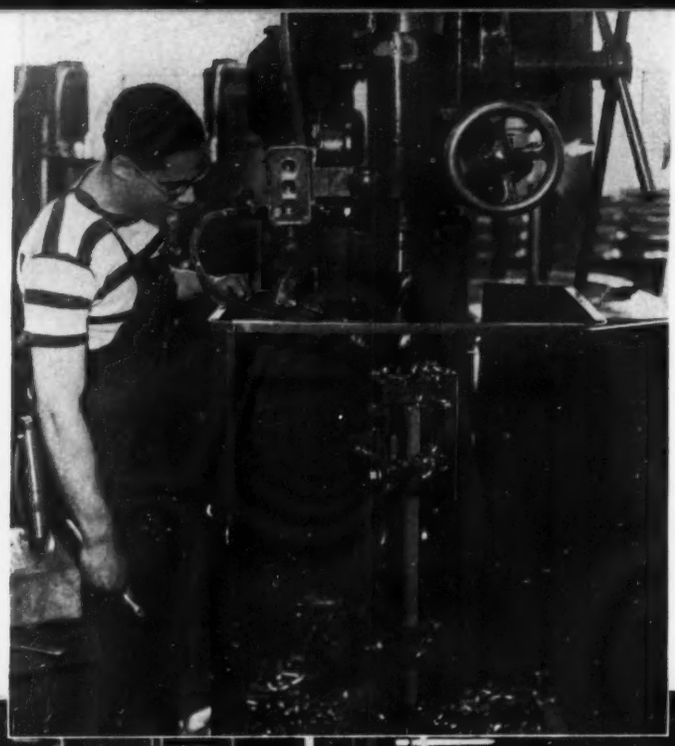
The sixth step on the bolt, and shown in Fig. 7, is done in two operations; formerly it required four individual operations, one on each side and the top and bottom of the piece. This reduction in number of operations was accomplished by setting the piece in the fixture at an angle of 45 deg. and grinding it from the periphery of the wheel. This procedure is possible because of a special form-grinding attachment built into the machine for dressing the wheel. Girl operators on this job check the piece while it is in the fixture, indicator gages being mounted on the fixture for that purpose.

Since the gun lock is a mechanism calling for close tolerances and high finish, here again the work is suited to the delicate fingers of the girls. The operations are about equally divided between milling and grinding. Surface grinding is regarded as specially important. The young women on this work are grinding parts to tolerances of 0.0005 in.

In grinding first one side and then the other of the boss, latch end, and side of the lock, each operation was originally performed separately on one lock at a time. But fixtures have been designed so that six pieces are now ground at one time.

For grinding between latches, a Delta bench grinder was taken and adapted by the designing of proper fixtures. Likewise for further grinding on the latches the Boyar-Schultz profile grinder, regarded as strictly a toolroom machine, has been equipped with fixtures designed for the job.

Although women operate machines in the bolt and lock departments, men do the setting up where heavy lifting is involved. But in a substantial percentage of



The hole in the breech block wherein the barrel will ultimately be inserted is first drilled to 1¾ in. diameter in this Baker drill press. The fixture that holds the breech block permits drilling the hole in one operation, eliminating a pilot hole drilled previously

Surfaces on the channels of the breech blocks are finished on Thompson grinders equipped with high-speed attachments. This and other grinding operations on the breach block, bolt and barrel of the 20-mm. cannon has speeded production of these aircraft and anti-aircraft weapons

An elaborate series of operations, including rough and finish boring, chamfering, reaming and tapping various holes in the breech block is performed on this horizontal one-way Natco combination driller and tapper

the operations the girls are handling the set-up themselves.

Some of the other parts for the 20-mm. cannon, those made by subcontractors, require finishing operations after being delivered. One such part is the muzzle brake sleeve in which nine rows of slots, four at a time, have to be cut. The sleeve is set in an indexing fixture for this operation. After slotting, the sleeve is threaded on a No. 16 Geometric threading machine.

Cutting fluids used for the machining operations are as follows: 1:25 soluble oil for milling; 1:8 soluble oil for grinding; 1:1 mineral-lard oil for broaching, although 1:4 soluble oil is also used. On the Natco deep-hole driller, a mixture of 80 percent sulphurized oil and 20 percent light mineral oil is used.

Harvester has endeavored to standardize on cutting fluids. They are piped from tanks in the basement of the plant direct to the various machines. The mixing tanks and the barrels in which the cutting fluids are received are in a locked room to prevent anyone other than delegated persons from handling the fluids.

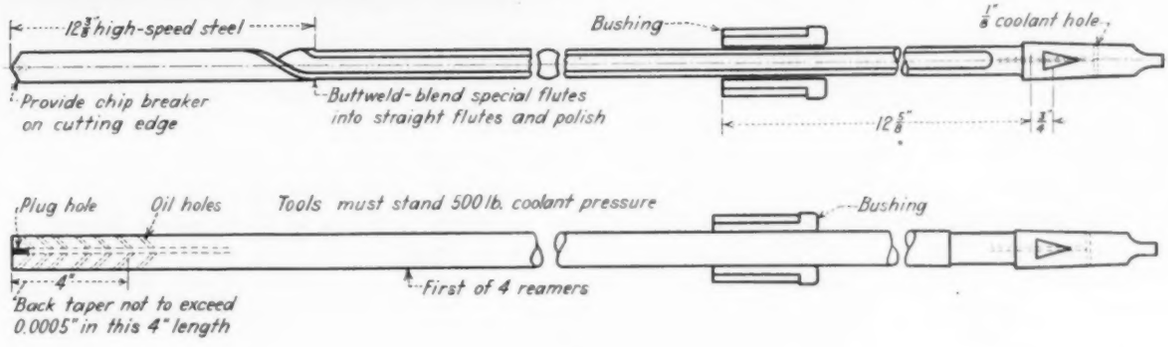
In none of the departments involving operations on the gun barrel, the breech block, the bolt, the lock and other parts, do operators lubricate the machines at which they work. It has been especially desirable to avoid this since so many machines are operated hydraulically, and many of the operators never run machines before their employment on the 20-mm. gun at the Harvester plant. A special crew of oilers attends to the lubricating. All fittings requiring the same kind of oil are painted the same color.

Another practice which has been effective with the new employees, and also the more experienced, is the posting of 11x17-in. blueprints containing drawings covering operations by operation numbers on the respective machines. The blueprints describe the part and give minute details on the operation for the guidance of the worker. This practice is much more effective than verbal instructions.

After joint company and government inspection of the barrel, breech block, bolt and lock, as well as all

Twenty holes in the breech block are drilled, countersunk and reamed on this Natco vertical drilling machine. The fixture indexes to six stations for completing the forty operations on the block at this machine. National Automatic Tool Company and United States Drill Head Company cooperated in perfecting the pilot and bushings for this job

Fig. 6—The drill and reamers for semi-finishing a 1.181-in. hole in the breech block are aligned by guide bushings. Chips are removed by coolant under 500 lb. pressure. The hole is finished by broaching in five steps



MAJOR OPERATIONS ON THE BOLT

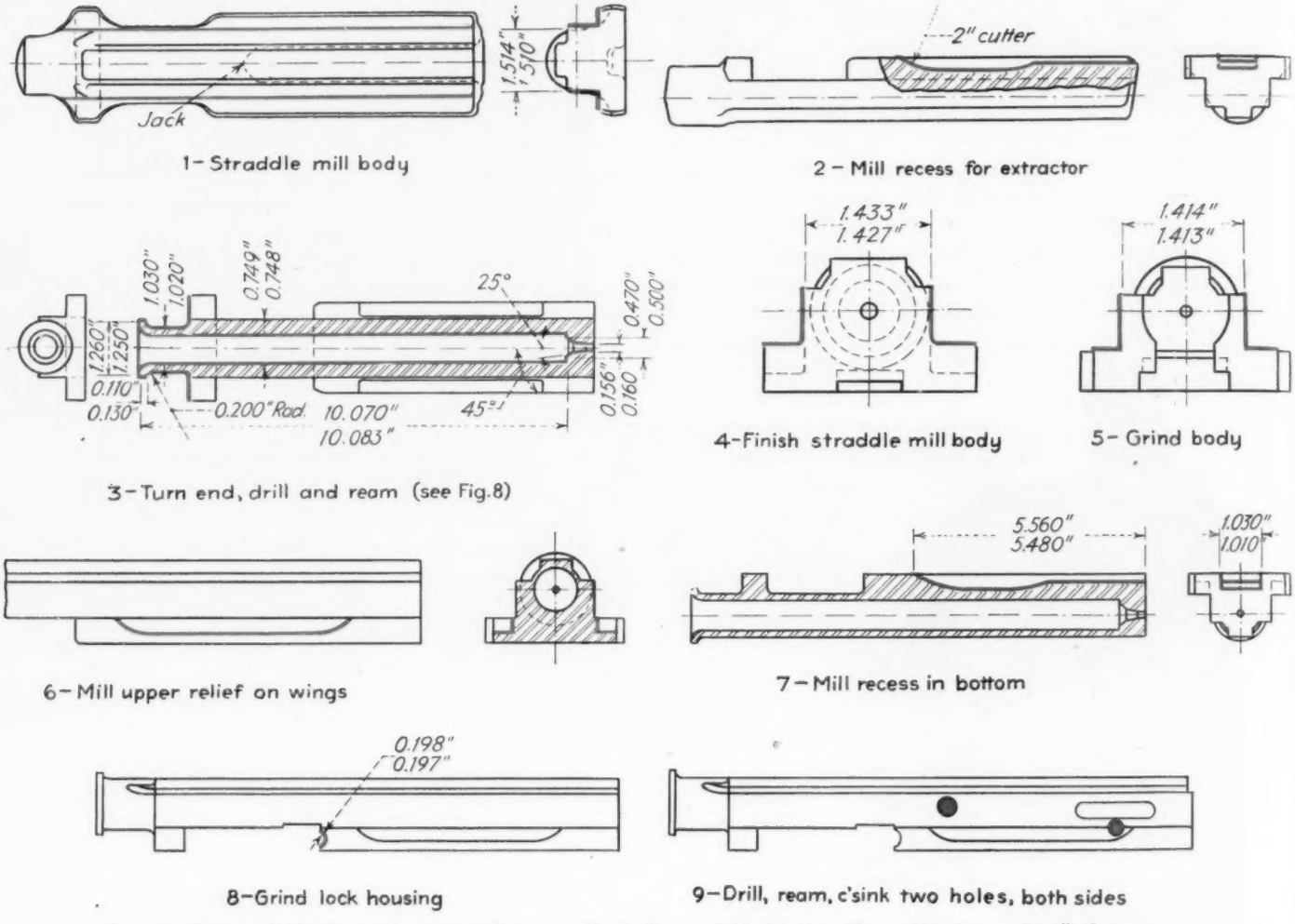


Fig. 7—Many of the important operations on the bolt are indicated in these drawings. In all there are 52 operations, all but eight of which consist of milling and grinding

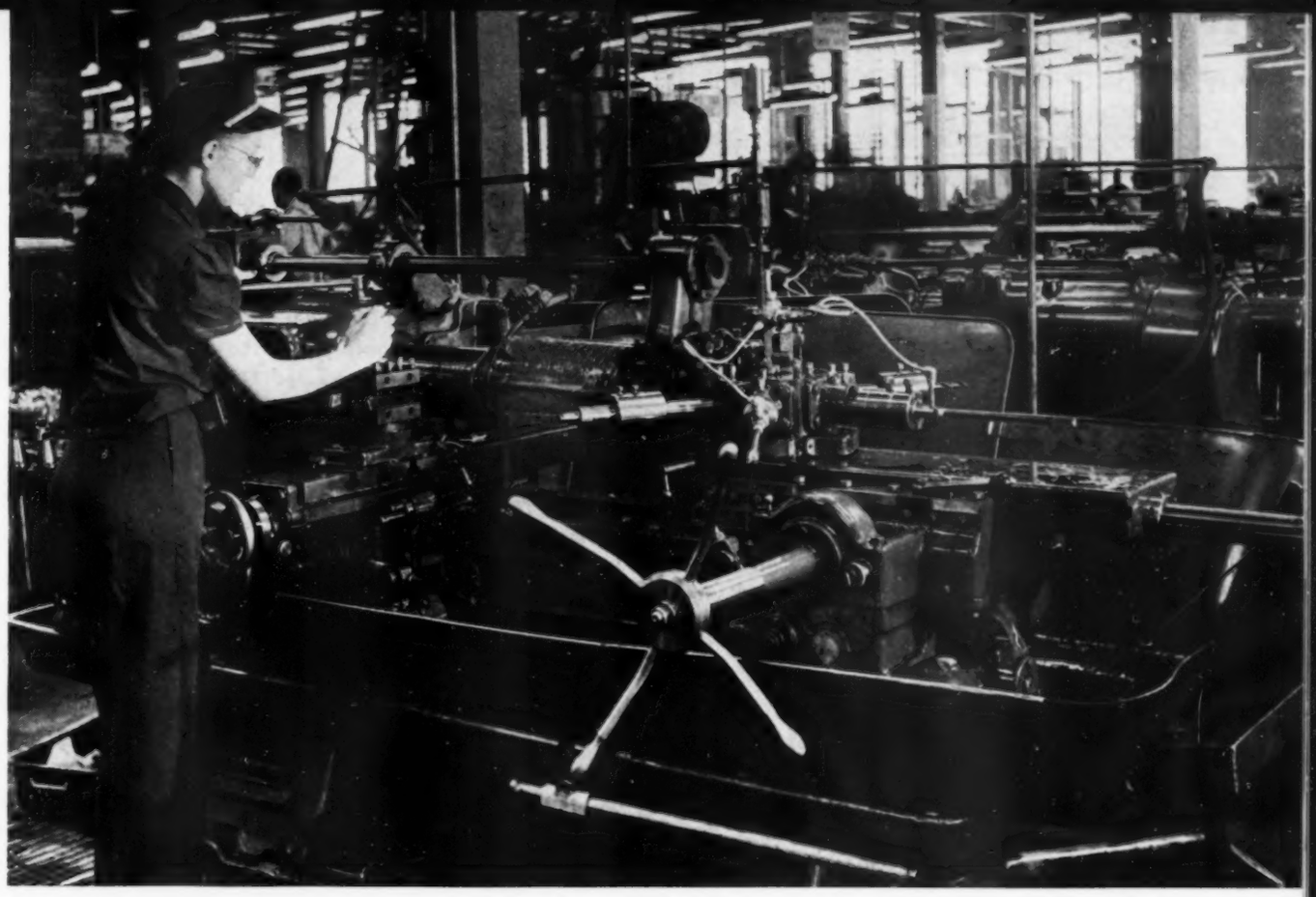
pieces furnished by subcontractors, all parts are brought together for assembly. Drilling and line-reaming holes in the breech block and its side plate is followed by riveting these two parts. This is done with a R. E. Ellis Engineering Company riveting machine which squeezes three rivets at one time. The gun barrel is stamped with the manufacturer's identification monogram, serial number and data pertaining to the type of weapon. Such stamping is done on a George T. Schmidt, Inc., marking machine.

The bracket of the gas tube is expanded for shrinking, shrunk on the tube, and then drilled and reamed for taper pins. In this operation the bracket must be kept in line with the gas hole in the barrel. The barrel is screwed into the breech block and reamed at assembly by means of a Thor air drill. After this all parts are assembled to complete the gun and it is sent out to be proof fired.

When each gun is returned from proof firing, it is disassembled and all parts are thoroughly washed, the barrel being washed out with a solution of soda and water. The bore is gaged again with a boroscope and star-gaged for diameter, as in the original inspection before assembly. After that it is re-assembled and given a final inspection by Ordnance inspectors. Ordnance insignia is then etched on it.

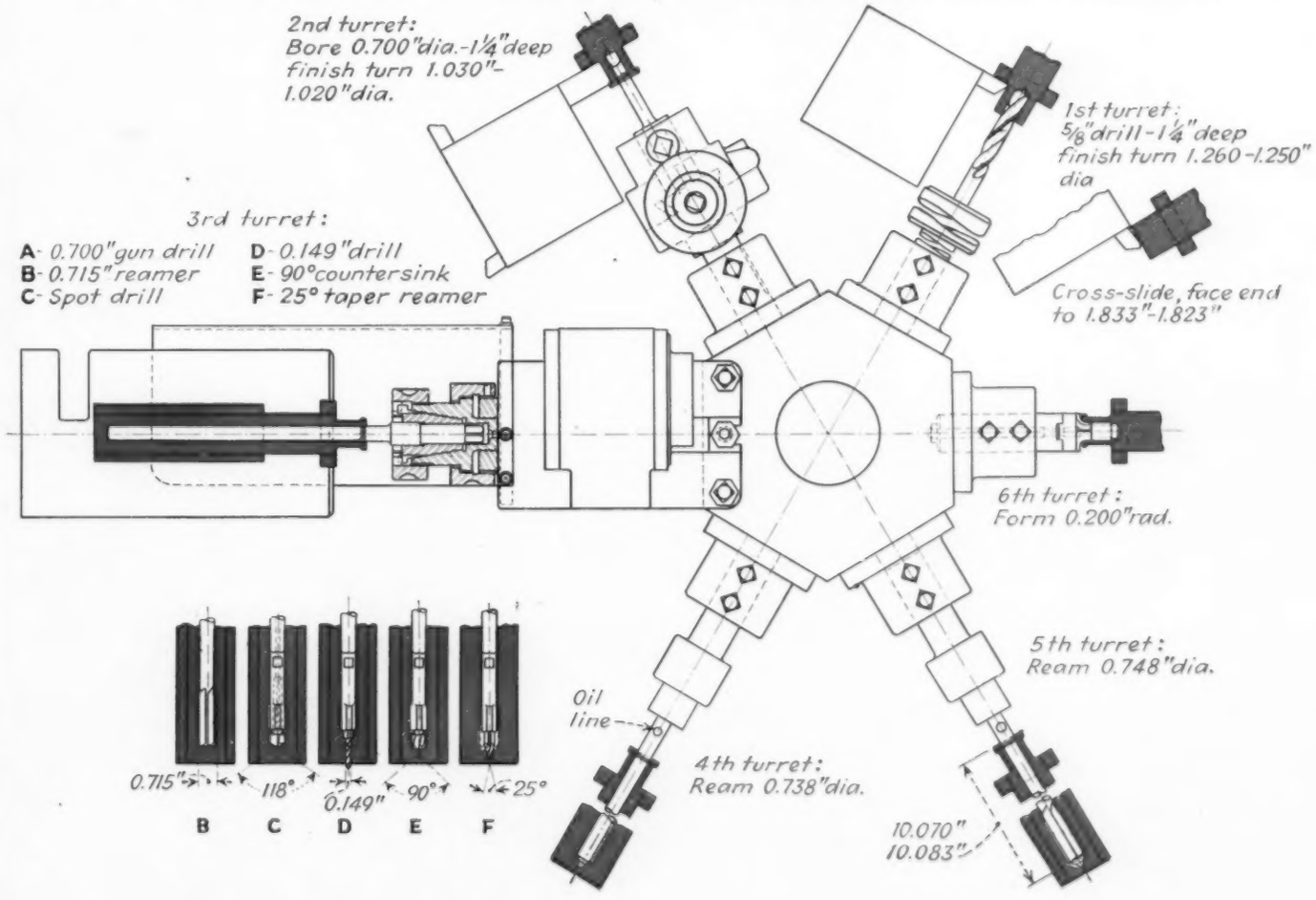
The gun then moves to an overhead conveyor, through a degreaser, into a paint booth to receive a sprayed coat of Army olive drab, and finally through a double bank of infra-red drying lamps. Finally it is dipped in rust-proof oil and raised by air hoist to a rack to drain. It should be mentioned that the recoil spring and the muzzle end of the gun are painted separately. Finally the cannon is packed in wooden boxes for shipment to Army Ordnance depots.

As already indicated, inspection all along the production line is thorough. It is carried out by company and Army Ordnance people in parallel. Unlike some war production companies, the Harvester 20-mm. gun works has not put its own inspectors directly under



The bolt for the 20-mm. cannon is mounted in a fixture on a J&L turret lathe for boring, reaming, chamfering and countersinking the center hole, as well as turning and facing the end. The operations performed at each turret are shown in Fig. 8

Fig. 8—This set-up is used on No. 3 Jones & Lamson turret lathes for performing thirteen operations on the bolt. The set-up is typical of others where as many operations as possible are performed in one chucking



supervision of the government men. But they do work in close cooperation. The company force of inspectors, including some women, numbers 142. The government force numbers 30.

An outstanding feature of the company's inspection work is that done by fourteen layout inspectors whom it has developed. The layout room has $175,000 worth of equipment, including that for checking gages to one-millionth of an inch.

It is important, for example, to get the firing pin in the center of the bolt body. Most important is the gas plug. In drilling and reaming, the tolerance is 0.005 in. from 0.063 to 0.068 in. One-thousandth on the diameter of the hole increases the gun's firing rate 25 shots a minute. A gun may shoot 525 rounds with the 0.063-in. limit, but with the 0.068 limit it will shoot over 600 rounds.

Firing Tests

At the firing range, under the high roof of a twine mill long abandoned, twelve miles away from the plant, every gun is given proof firing, function firing and endurance tests. The shooting is from seven booths into a sand pit 90 ft. distant. The sand is conditioned periodically and the shells cleaned out by a conveyor and a specially designed exhaust system.

Proof firing consists of two single shots, three automatic, six automatic, and one single high pressure. Function firing is with two full magazines of 60 rounds each. For endurance tests, one gun out of every 200 that have passed the other tests is selected at random and subjected to fifteen magazines of firing. The specifications call for 500 rounds a minute, but Harvester tests are averaging over 600. Production men and women in the plant have been given a good idea as to what the guns will have to do when they go out to the firing range.

First Production Problems

Not getting standard machines, but recruiting and developing machine operators, both young men and young women, and recruiting and developing inspectors, tool engineers and toolmakers have the big problems in Harvester's production of this cannon. For all of this, elaborate training programs have been carried out. To develop the women operators, for example, the company hired them from many walks of life—office girls, sales girls, beauty parlor operators, a woman law-school graduate—and sent them to one of its other plants for preliminary training. From this

A 1.573-in. slot is machined in the bolt on this American hydraulic broach. This operation supersedes milling and filing, with a resultant increase in production

The bolt is set in a fixture which locates it precisely for grinding the sides and top of the pads. This 12x20-in. Thompson grinder, equipped with a high-speed attachment, has a form wheel for doing this job

several of them emerged as supervisors and trainers of others. Likewise to develop inspectors, particularly layout men, the chief inspector and the industrial relations manager went to all the small colleges within a radius of 100 miles of the plant and obtained men with a foundation of mathematics to come into its extensive training classes. They also recruited from various vocational schools and Federal training projects.

The superintendent at the Harvester 20-mm. gun works, a war production veteran of World War I, has recently had experience in defense production at another plant of the company—tooling up for forging, machining and finishing 75-mm. shell. That involved problems, but the 20-mm. gun job had more. When asked for pointers that might be helpful to other manufacturers taking on contracts for the 20-mm. cannon or a similar one, he said in part:

"The big problem for any manufacturer would be, as it has been for us, securing skilled help, and that means training employees. For several months we have run a school 24 hours a day. At first we borrowed 50 skilled men from other Harvester plants, and they were here about three months training employees.

"An early problem under a contract like this is to get the machines for a pilot line. While waiting for them, we borrowed machines from other Harvester plants. Incidently in tooling we have had the benefit of getting some small cutting tools from the central salvage department established by the company for all its works. We borrowed men to train toolmakers and tool designers. We got young fellows from schools and colleges to take that training.

"Then the extensive designing of tools by our engineering department has been necessary; anyone else would have to do the same. We are particularly proud of the fixtures and equipment provided by our tool engineers for the continuous production of breech blocks. This is also true of the grinding methods developed by our engineers to make possible the grinding of the inside channel on the breech blocks. Likewise we have promoted the use of tungsten-carbide in the drilling of the gun barrels. It has also worked well in drilling the bolt and some holes in the breech blocks.

"A big factor contributing to the success of our program has been the willingness of everybody to work day and night—directing every effort toward VICTORY."

In this purchase inspection crib, small parts supplied by subcontractors come in on a conveyor to factory inspectors for visual and mechanical checking. Every part is given another check by government inspectors

Rolls Apply Paint to Aircraft Parts

ALUMINUM SHEETS for aircraft parts are now painted by a continuous process known as roller coating. This method of painting is employed by the Douglas Aircraft Company.

One coat of zinc chromate is applied before the sheet is processed, eliminating priming coats, intermediate cleaning operations and anodic treatment. The only subsequent painting on the airplane is to apply the camouflage on the exterior surfaces. Formerly the painting process required many steps which frequently meant priming, stripping and retouching. Now the paint is applied once by this automatic method.

The process has certain advantages:

1. It separates painting from fabrication and thus avoids any interruption to the forming and assembly operations.
2. It reaches all surfaces, even those covered by mating pieces in the assembly.
3. It eliminates the necessity for spray guns or a spray booth for the priming coat.
4. The paint has no thick or thin sections.
5. Roller coating is faster than spray painting.
6. It saves paint.

Roller coating resembles the process of printing in that the paint is applied by a roller supplied from a well in much the same manner that ink is transferred to a printed page.

The equipment used for roller coating is about 100 ft. long. The first stage is an endless Neoprene belt upon which the aluminum sheet is laid flat. The belt carries the sheet into a degreaser, which is a closed cabinet containing sprays above and below the sheet. This cabinet contains a 4 percent caustic solution, heated to 180 F. by a series of electric heating units in the base. The solution is circulated through the sprays by means of a pump.

A second cabinet similar to the first, including the heating and spraying equipment, contains plain water and is used for a hot rinse.

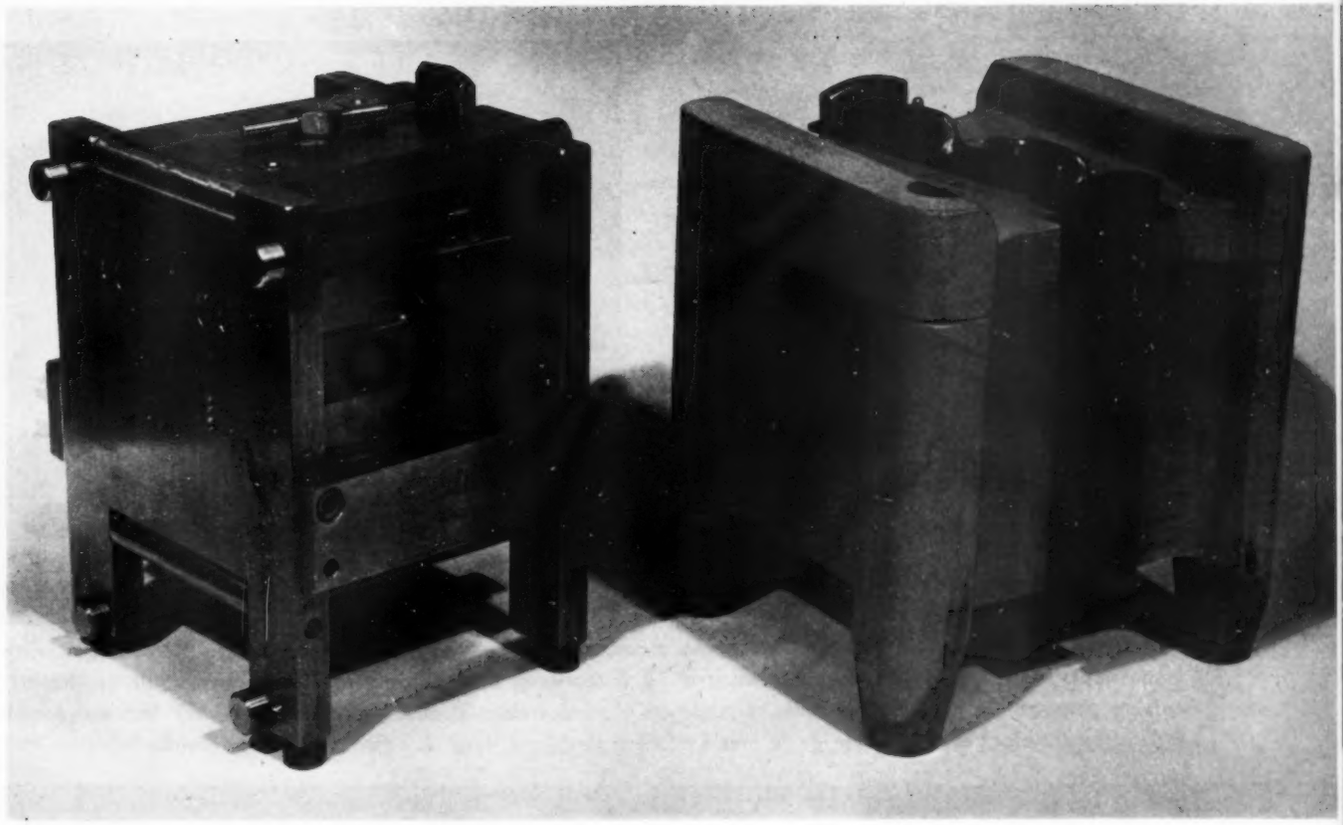
From this cabinet the sheet emerges to a studded chain conveyor which carries the sheet leaving both upper and lower surface exposed. Three exhaust ducts extend across the sheet as it leaves the rinsing cabinet to aid drying. Following these ducts, eight air nozzles play on the surface of the sheet to make sure that all moisture is removed before painting. Then the sheet goes through the painting rolls which distribute the paint uniformly. A tank at this station carries a reserve supply of paint which flows to the well by gravity.

The painted sheet travels along on a second section of Neoprene belt. The end of this portion of the roller coating machine parallels the start of a second machine. The sheet is transferred to this machine, paint side down in order that the opposite surface may be painted. This machine is identical to the first except that it contains no degreasing or rinsing stations.

The speed of the various conveyors can be controlled by Reeves variable speed drives.

The process does not meet all conditions. For instance it is not suitable for parts to be spot welded, deep drawn or hammered. However, it is used successfully for simple forming operations such as flanging and beading.

Use of roller coating saves about 3,000 man-hours on a large airplane.



Much time has been saved at the Vega plant by making simple drill jigs out of cast plastic instead of steel. At the right, above, is a plastic drill jig for the same part for which the steel jig at the left originally was made

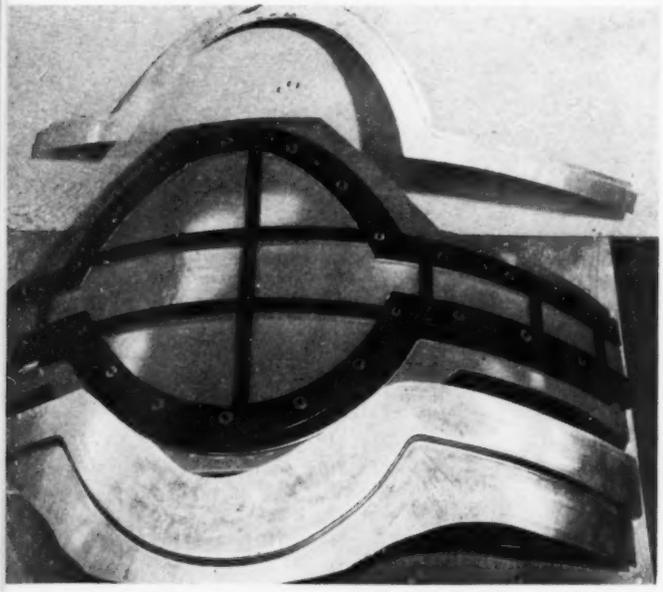
Jigs and Dies From Cast Plastics

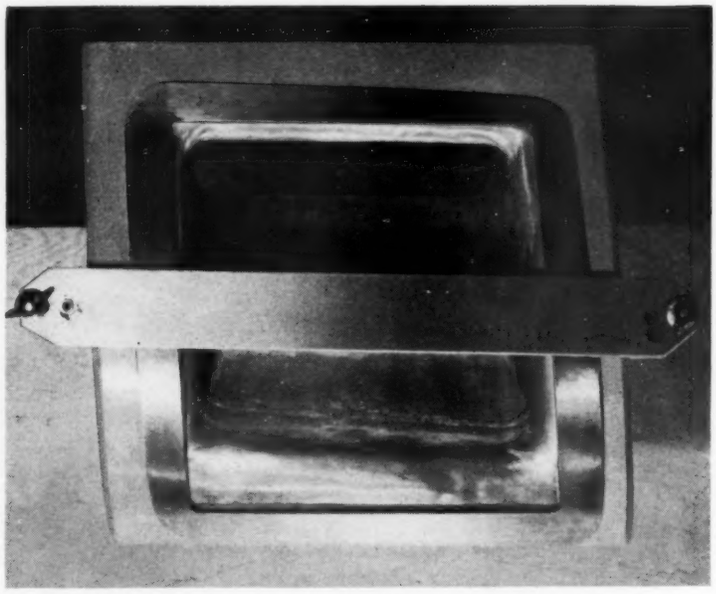
THE LOCKHEED and Vega Aircraft Corporations in the past few months have started to produce drill jigs and other tools of plastic materials, including dies that will stand up under 8,000 lb. per sq. in. pressure in hydraulic press forming operations. The original development work in this field was started by M. D. Basolo, foreman of the Lockheed Wood Shop, and has been carried forward along slightly different lines at Vega by Carl Hill of that organization's Plastic Tool Development Department. The Production Research Group also assisted in later developments.

It was Mr. Basolo's idea (which has been described by him in a patent disclosure) that drill jigs can be fabricated by securing the drill bushings to a master part, placing the part in a form, and pouring a molding of material around it. When the material has solidified in conformity to the contour of the part, the bolts holding the bushings in position can be removed, and the jig then finished for use. Plastics for tools were accepted with reservations at first. Gradually, however, plastics have gained in popularity, and plastic tools now dot the major and subassembly lines in both plants.

Of the several materials studied, Lockheed has adopted a phenol acetone thermoplastic, while Vega at present is using an acid setting phenol formaldehyde thermosetting composition that is made up of 25 to 30 percent ground walnut shell flour, used as a filler, with resin and an acid catalyst or accelerator. Other good fillers include wood flour, Masonite and scrap plastic.

Among the outstanding features developed by the current investigation in the plastic tooling field are: (1) plastics may be substituted for steel and dural in many cases; (2) tools may be cast to a master part or plaster mold more quickly than by forming, milling, or hand fitting; (3) duplicate tools may be fabricated at less cost than the original, due to the fact that molds are saved; and (4) duplicate tools





The advantages of plastic tooling are especially pronounced in tools that require fitting to contours. This Vega hand router block, plastic nest and drill jig is made of an acid setting phenol formaldehyde thermosetting composition in which the filler is made of ground walnut shell flour. *(Above, right)* This hand-form block and trim line gage made of cast plastic at Vega is light and easy to handle

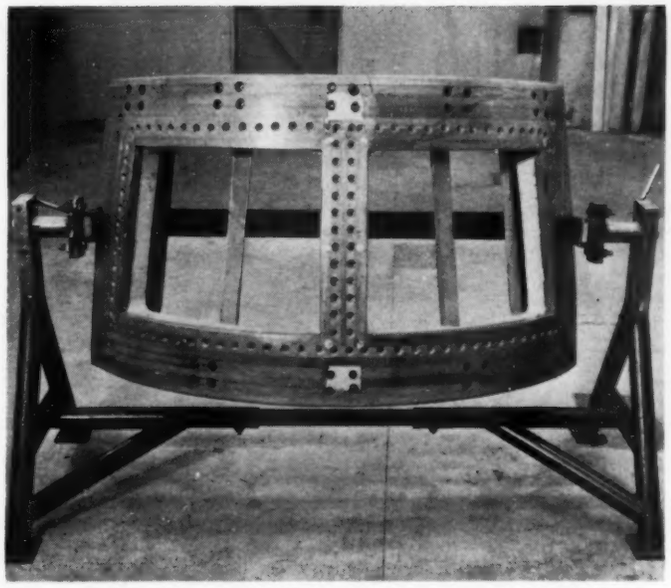
may be made economically and quickly for transportation to other plants.

The time factor—to which prime consideration must be given at this time by everyone involved in tooling programs—has been one of the plastic exponent's greatest selling points. It is believed at Vega that the portion of their tooling program on the B-17F Flying Fortress which has been completed through the use of plastics, involving three months' work, would have required five to six months if wood, dural and steel had been used. Many of the jobs performed during the three months period have been those which threatened to interfere with production schedules if not done quickly. Such results are possible because plastics lend themselves readily to casting to a master part.

If templets or engineering data are not available, but a master part is available, time is saved in making the actual tool, and the time ordinarily necessary to obtain data and make the templets is eliminated. In this case, the master part is used by building up the sides to allow for proper thickness of plastic and then casting directly to the part. An exact reproduction of the contoured part is obtained by this method, thus eliminating much machining and fitting to templets. Techniques have been worked out to allow for part thickness when casting to a master part, and allowances can be made for part tolerances by making the casting oversize even when casting to a master.

The research work undertaken in developing this method of producing tools has shown that a satisfactory thermoplastic material for drill jigs, forming dies and other tools should meet the following requirements: (1) it should be castable at 225 to 325 F. and have a minimum softening point of 200 F. —these requirements make it possible to cast the tool in an aluminum alloy part without damaging the latter, and avoids the danger of softening of the jig due to heat generated by drilling; (2) it should be possible to reclaim the material cheaply; (3) it should be possible to finish the material on standard woodworking tools; (4) it must have sufficient impact strength to withstand shop handling; (5) it must not exhibit brittleness at low temperatures or after aging; and (6) it must be resistant to lubricating oils and metallic chips formed in the drilling operation. In addition, means for controlling shrinkage of the molding material should be available.

Vega has conducted experiments and research in both the thermosetting and thermoplastic fields, and has found that the thermosetting cast materials are applicable to drill jigs, formed router blocks, shaper blocks, saw jigs, checking fixtures, hydraulic press form blocks, dies, punch jigs and forming dies for Plexiglas—in other words, these materials are suit-



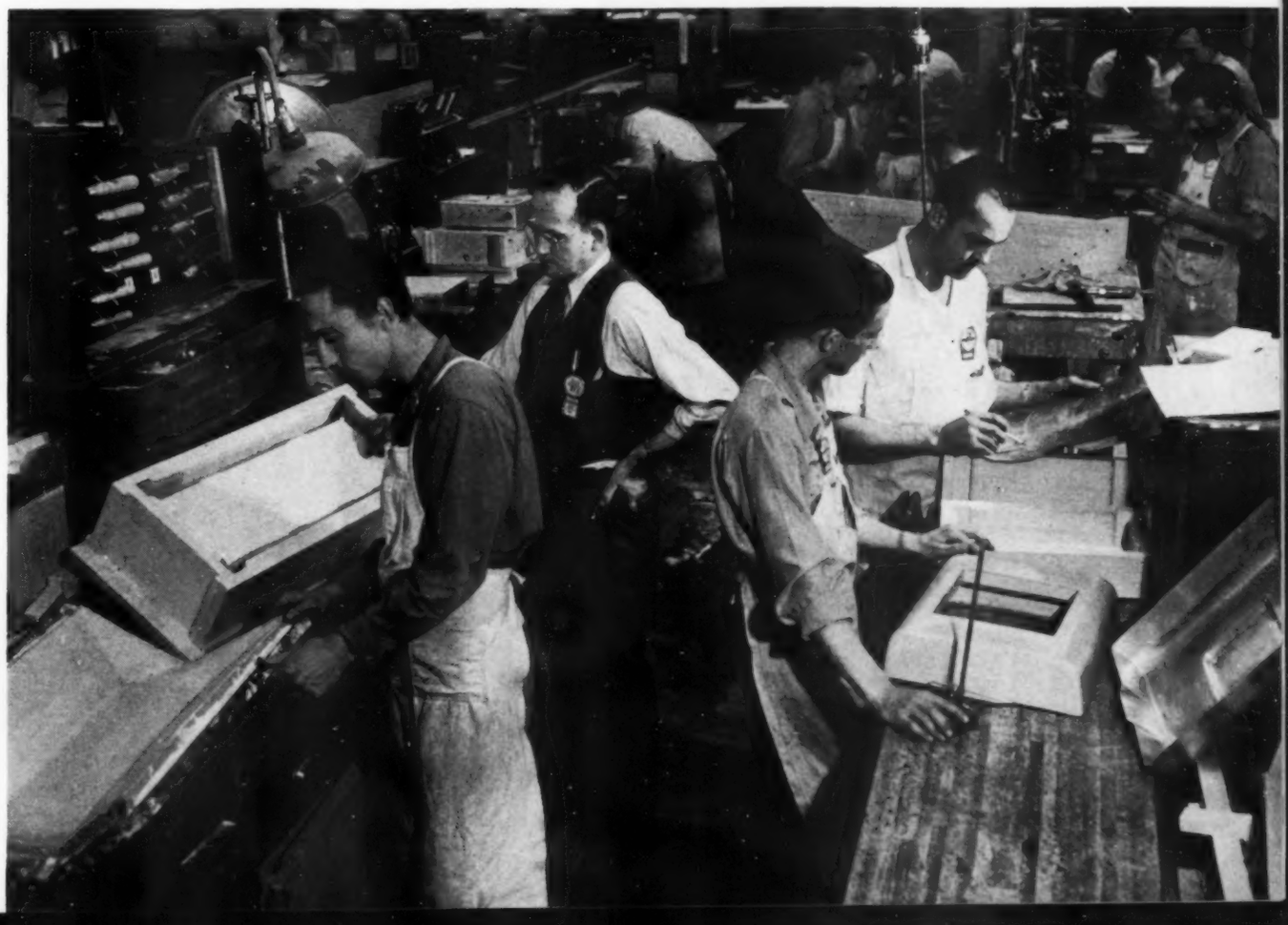
This Vega plastic drill jig for a pilot's escape hatch assembly is backed up with a mahogany wood frame to absorb the shock of the drill motor. Note that the material above each drill bushing is countersunk

able for most jigs and other tools that involve contours. Plastics do not show any particular advantage for jigs where no contour is involved, except from the standpoint of conserving vital materials.

In cast phenolic drill jig plates it is not possible to cast the bushings directly in the drill plate. Locating the bushings, however, is accomplished quickly and efficiently by casting Cerromatrix around the bushings which, in turn, are located to the master part of templet by means of pins, oversized holes having been drilled in the plastic plate to accommodate the bushing and Cerromatrix. These bushings are especially designed for thermoplastics and are of sufficient wall thickness to eliminate the possibility of their becoming over-heated and losing their location. The bushings, incidentally, are made quickly, because only the inside diameter need be finished accurately. On one drill jig that was made recently there was a saving of $70.11 in the cost of bushings alone.

Router blocks, shaper blocks and saw jigs made of plastics have two, partciular points in their favor. They can be cast to a contour and have a natural resistance to the soluble oils used in the fabrication of parts. They do not warp or change size because of moisture absorption. With the addition of a acid

Molds for casting plastic tools are made in the Vega wood shop in line with carefully worked out instructions. Wood molds are coated with four coats of clear lacquer, while plastic molds are treated with Bayberry wax and then sprayed with four coats of clear lacquer



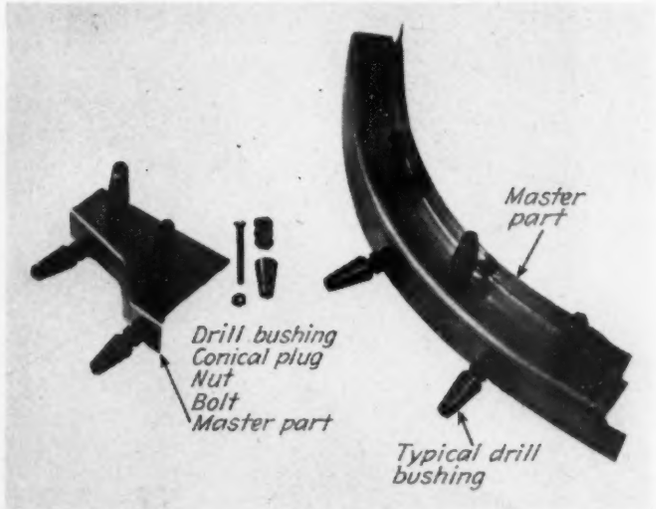
In Vega's plastic shop, bakery equipment has been adapted to the production of airplanes. In the background an ordinary baker's bread mixer is mixing the thermosetting plastic, while in the right foreground a worker inspects a finished casting just removed from the baker's cookie oven used to cure the plastic tool castings

catalyst to the base resin, Vega is now able to set up and finish the average work in plastics in eight hours —work that may take from three days to two weeks by former methods.

For hydraulic press production tools, where a minimum of 1½ in. draw can be maintained, applying external beads as stiffeners around lightening holes in flat work, the application of plastic tools can help speed up production by using two or more duplicate tools which are cheap to manufacture, and easy to handle. The development work can be done with a wood form block and a plaster split mold can be made to this wood block. Using the plaster split mold, duplicate tools can be cast of plastics, the split mold being saved for use in the event of breakdowns.

Woodworking machinery is used for finishing plastic jigs and form blocks at the Vega and Lockheed plants. The part shown is a plastic nesting block

(Below) Drill bushings are bolted through the master coordination holes in the templet or sample part. This assembly is placed in a retaining form and the plastic material is cast over the part and around the drill bushings. Later, the cone plugs are removed



Plastic will not move under pressure, thus definite mold lines can be maintained so long as pressure does not exceed 8,000 lb. per sq. in., when forming any kind of material. The only impact requirements of plastics are that the material withstand dropping on a concrete floor and normal impact incurred in loading and unloading the jig or hydraulic press.

Tests on early compounds of the phenol acetone thermoplastic resins at Lockheed showed very favorable results, and immediate applications appeared feasible at first. However, it was demonstrated that these materials possessed definite aging properties which were not desirable. The aging appeared to be due to the crystallization of the excess maracaibo wax which had to be added to make the material more inert to soluble oil. This crystallization precipitated wax fracture planes. The problem apparently has been solved by removing the major portion of the maracaibo wax. Inertness to oil has not been adversely affected by decreasing the wax content from 3 to ½ percent.

Having overcome this first difficulty, the problem was resolved into one of compromising between softening temperature and impact strength. Plastic materials having good impact strength tend to have too low a softening point. However, considerable variation can be obtained by varying the type and quantity of plasticizer used. The first compounds treated with liquid plasticizers had relatively low softening points, so that on very hot days clamping devices on a drill jig made of these materials would sink into the surface.

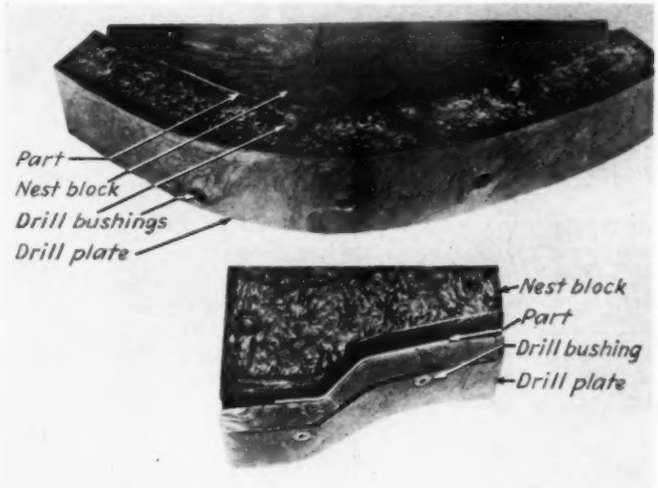
A chemical company then succeeded in developing a solid plasticizer which raised the softening point from 150 F. to approximately 250 F. The resulting material had excellent casting characteristics, and a high softening point, but was unsatisfactory in practice, because of brittleness. A compromise has been reached by adopting a part liquid, part solid plasticizer, which resulted in a blend of resin with the desired properties.

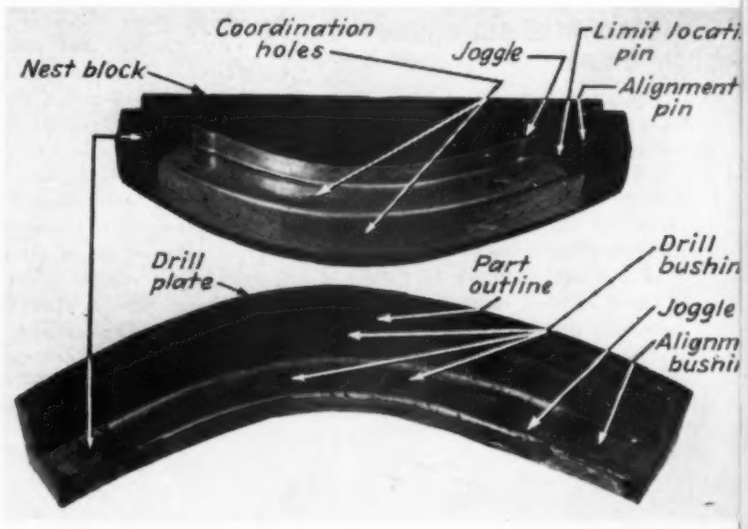
The development of this project has included not only the determination of a suitable plastic material, but also the perfection of a technique for fabricating the jig using such a material. The type of part to which this process is best suited is an open contour with or without joggles. The equipment required for making the plastic drill jigs of the material selected by Lockheed, consists of a jacketed kettle equipped with a device for agitating the mixture. The jacket on the kettle contains a liquid bath which is heated to maintain the desired temperature throughout the kettle. Maintenance of uniform temperature is extremely difficult without such a bath surrounding the kettle. The only suitable alternative would be the application of an electric heating element wrapped around the kettle. The agitating device should be of the full-scraper type so as to continuously scrape the material from the side and bottom of the kettle.

At Vega, the thermo-setting composition is mixed in an ordinary baker's bread mixer, and then baked at 175 F. in a cookie oven.

At Lockheed, phenol acetone thermoplastic molded drill jigs are fabricated from master part templets which have master coordination holes. Drill bush-

before the cast plastic is finished on a joiner. *(Below)* After nest blocks and drill plates have been cast in wood or plaster molds at the Lockheed plant, the sample part is placed between these two pieces and the assembly clamped together. Then, holes are drilled through the ends for alignment bushings. *(Below)* This Lockheed open jig shows how alignment pins and locating pins are assembled in the final production operations on the jig parts. Duplicate tools are easily made by this method





ings are bolted through the master coordination holes to the templet. This assembly is then placed in a retaining form, and the plastic material is cast over the part, around the drill bushings. Shrink is controlled by having the retaining form extend above the master part. Hence, when the hot plastic first contacts the cold part, it solidifies rapidly, freezing to the contour. As the remaining plastic mass progressively solidifies, plastic is supplied from the reservoir created by the retainer, terminating in a sunken surface on top.

The retaining forms are removed when the cast is cool, and the casting is delivered to the shop for machining. First, the cone-like plugs are removed, making the position of the drill bushings visible. Then, the concave free surface of the block is finished flat on a joiner, care being exercised to prevent the joiner blades from striking the drill bushings. In practice, the plastic is cut to within ¼ to $\frac{3}{16}$ in. of the external drill bushing face, and the hole to the drill bushing is chamfered as a finishing operation. These thermoplastic parts may not be sandpapered, as frictional heat causes gumming. However, a spoke shave or floor scraper will give an excellently finished surface.

To complete the jig, the part is placed between the drill plate and the nest block, cast in the same manner as the drill plate, and the assembly is clamped together. The alignment of the coordination holes in the part and the drill plate is checked by inserting the proper size drill rod through the drill bushings and into the coordination holes of the part. Next, ⅜ in. holes are drilled through the ends of the assembled jig for alignment bushings. These bushings are serrated about their outer circumference and are driven into place after the jig has been unclamped and disassembled. Alignment pins then are driven into the alignment bushings in the drill plate and held in place by heating a small amount of the plastic and flowing it into holes on the back of the drill plate.

Limit pins are driven into the drill plate at the ends of the master part, or may be placed through the part if it happens to contain pin holes used to locate the part during forming.

In jigs made of phenol acetone resin, the position of drill bushings may be altered by "drifting." This is accomplished by inserting a heated drill rod in the bushing, allowing the heat to diffuse momentarily, and then applying a force in the desired direction of movement. This facilitates alterations required by inspection.

If the part from which the drill jig is cast is extremely large, an alternative method of affixing the drill bushings can be used. First, the drill plate and

VEGA PHENOL FORMALDEHYDE THERMOSETTING TECHNIQUE

The following notes on the practical application of plastics in the tool shop at Vega were prepared by the Tool Research and Development Division of the Vega Aircraft Corporation. They apply to the acid setting phenol formaldehyde thermosetting composition which Vega at present is using for making jigs and other tools. It is made up of 25 to 30 percent ground walnut shell flour, as a filler, with resin and an acid catalyst.

MOLDS FOR ALL TYPES OF BASES

The advantages of plastic tooling are more pronounced in tools that require fitting to contours than straight surfaces. On formed router blocks, for instance, it is much more simple to make a form using the sample part as part of the form and cast a base, rather than blue it in and work it down by hand.

There are two methods by which this mold can be made. One is to back up the part with clay or plaster and build the sides of the mold around the part, extending the flanges with plaster to allow a larger base or nesting block than the sample part itself.

Another method is to use the sample part as a pattern and make a complete mold from the part. On large castings it is often advisable to use the plaster from which the Kirksite die was made to obtain the contour. When this is done, a splash is made of the plaster, and the sides are built up of wood.

It is better to use wood for the outside of molds whenever possible, because wood contains far less moisture than plaster and allows rapid penetration of heat. This insures a cured casting. In many cases the surface that is to be next to the part can be cast on plaster while the other surfaces can be cast against wood and later sanded.

If plaster is to be used entirely for the mold, the volume of plaster should never exceed the volume of the casting. Mold thickness should always be kept to a minimum. The reason for keeping molds thin is best explained by the action that takes place. When the reaction between the resin and the catalyst takes place, heat is created. The more volume we have in the casting, the more heat is formed. Thus, in a small casting, only a small amount of heat is created, and the casting is forced to depend on oven heat to finish its cure. If a small casting is incased in a thick plaster mold, it takes oven heat some time to penetrate the plaster. Thus, in many cases, in order to cure the bottom of the casting, it would have to bake so long that the top, which is exposed, would be over-cooked.

Molds of any material should be made in such a manner that they can be easily sprayed and then assembled and poured.

TREATING THE MOLDS

All plaster molds should be treated with one coat of Bayberry wax, let dry and sprayed with at least four coats of clear lacquer, sanding between the last two coats. The lacquer must be thoroughly dry before pouring with plastics.

Wood molds should be coated with four coats of clear lacquer, sanding after the first one. The last coat should be absolutely smooth. Regardless of the ma-

Hot liquid phenol acetone thermoplastic is shown being poured from the mixer into a plaster mold to make a wing-root fairing drill jig at the Lockheed plant. Standing at the right is M. D. Basolo, Lockheed wood shop foreman, who originated this method of making tools

terial used in the mold, the casting will reflect every detail of the mold surface.

DRILL JIGS

The above procedure outlined for molds holds true for all types of jigs. Drill jig bases fall in the same category as formed router block bases. In many cases it is desirable to use plastic bases and some other form of drill plate.

Weight is an essential factor in all tools. Bases should not be under ½ in. or over 2½ in. thick. On extreme contours, the bases should be made in the form of a shell. Bases should always be backed up with ½ in. Masonite to absorb the jar in handling and protect the edges. In cases of a shell for a base, the shell may be fastened to the base at points of contact.

When attaching wood or Masonite to plastics, coarse threaded machine screws are recommended. Holes are drilled and tapped as in steel. Machine screws should be as long as possible.

When using a thermosetting plastic drill plate, never cast the bushings directly in the plastic. Cast the plate blank and back drill from the sample part, locate the bushings and set in Cerromatrix. One precaution is vitally important. When pouring the Cerromatrix, be sure that it is not too hot, or it will expand and crack the plastic; 300 F. is the proper temperature for pouring.

No design for plastics should include sharp corners or protruding angles or flanges that may be knocked off or chipped in use. All radii should be as large as is permissible on the particular tool. Outside radii that have no bearing on the function of the tool should be at least ⅜ in. These may be sanded in many cases. Allow generous fillets.

Wall thickness should always be ¾ in. or more. Drill plates that are poured with a constant wall thickness should be poured fron one end, baked and left in the mold to cool. Thin sections poured from the flat side will warp.

HOLD DOWNS

Any standard type of hold downs may be used, always bearing in mind the fact that when the clamps are closed or tight, the plate should be resting solidly against the base and yet not have the drill plate in a strain.

DRILL BUSHINGS

Plastic hex bushings are available and are recommended where space is not cramped. In the event that space is limited, use gang bushings.

MARKING PLASTIC JIGS

Wherever possible, jigs should be stamped on the Masonite base. When this is not convenient, and it is necessary to stamp the plastic, it should be done with a rubber stamp using India ink. When the final coat of lacquer is applied, which should be the last operation before inspection on all plastic tools, it seals the ink so that it cannot be rubbed off.

PLASTIC FORM BLOCKS

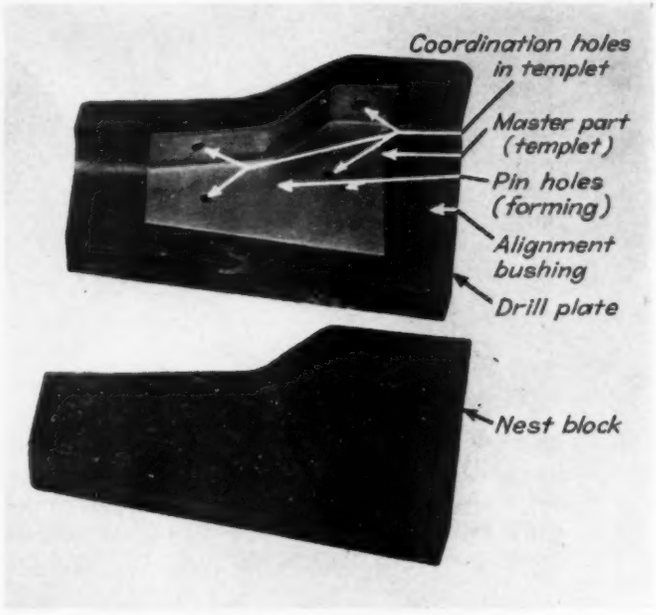
All plastic hydroform blocks should be mounted on a Masonite base projecting all around the block ½ in. On blocks that are to be 2 in. high, the plastic should be poured 1½ in. thick. On thicker blocks, 1-in. Masonite should be used. Blocks should be standard 2 in., 3 in., and 4 in.

If a wood pattern is made, it should be made to shrink scale. The shrink of

the nest block are cast as outlined above, except that the drill bushings are not bolted to the master part. When the drill plate has been planed to the length of the drill bushing, the master part is nested and holes backdrilled through the templet and drill plate. After disassembly, the pilot holes are enlarged to 1-in. diameter. Then, the drill bushings are mounted on the master part, and the master, the drill plate, and nest block are reassembled and clamped. Then, sufficient plastic is cast around the bushings to bond them to the drill plate. When this added plastic has hardened, the various pieces are disassembled, and the bushings removed from the master part. Finally, the jig is finished, as described above.

Drill jigs made in this way are ready for service after inspection, and if given proper treatment will prove satisfactory for innumerable parts. If the jig becomes damaged or obsolete, it may be returned to the plastic shop where facilities are available to salvage the plastic material, and the drill bushings and alignment accessories.

Much thought has been given by Lockheed and Vega, the first to use cast resinoids for extensive tooling, to all types of tools. Designs for proposed plastic tools have been scrutinized closely, and personnel has been trained, not only in the making of the tools themselves, but also in determining their adaptability and the choice of the various compounds for the different applications. It should be understood that plastics are not a cure-all, and that one plastic will not do all the jobs. Plastics as a whole have their limitations; much depends on the tool itself and the work it has to do. They cannot be used for every job.



Plastic drill jigs have a long life if given proper treatment. At Lockheed, if a jig becomes damaged or obsolete, it may be returned to the plastic shop where the plastic material and the metal bushings are salvaged and used again

Nega Phenol Formaldehyde Thermosetting Technique (Continued)

the oil tool resin is 1/1[illegible]
A plaster splash is made [illegible]
and the splash used as a mold.

MIXING THE RESIN

The mixing of the resin must be thorough. If the catalyst is not well mixed, there may be spots in the casting that will not set up. Also, if the fillers are mixed with the resin before the catalyst, the fillers will absorb some of the catalyst and form lumps of catalyst-filled filler that will not be mixed with the resin. For these reasons, it is better to first mix the resin and catalyst well, then mix in the fillers, the batch should then be thoroughly mixed and all the lumps beaten out of the fillers.

Excess plastic should always be poured (about ¼ in. on large castings and ⅛ in. on the small ones) to allow for surfacing off the bubbles that will rise to the surface.

Castings should be allowed to set outside the oven for at least ½ hr. before baking to allow the air bubbles to rise to the surface.

Here are a few "Don'ts" that are the results of experience and experiment:

a. Don't lacquer a hot object.

b. Don't use aluminum lacquer to coat a mold..

c. Don't pour plastic into a mold when the lacquer is not dry.

d. Don't put a lacquered mold in the oven immediatedy after spraying.

e. Don't use shellac on molds.

f. Don't cast around metal inserts without immunizing.

g. Don't experiment with actual tools.

h. Don't mix the different types of lacquers or thinners.

BAKING

The baking time depends upon the size of the castings. It also depends upon the type of mold used and the thickness of the material used in the making of the mold. The following table is to be used only as a guide and not as a strict rule. It is based on the actual baking time of the plastic and does not include the time necessary for the heat to penetrate the molds. The baking temperature is 175 degrees Fahrenheit.

Castings up to 1 gal.....2 hours
Castings 1 to 2 gal.....2 hours
Castings 2 to 4 gal.....3½ hours
Castings 4 to 8 gal.....4 hours
Castings 8 to 12 gal.....6 hours
Castings 12 gal. up.....8 hours

If a casting is soft and pliable when it is taken from the mold, it is still green. It should be hard and completely cured when it is taken from the oven. If a casting is pulled green and put back into the oven to cure, it is likely to get soft, pull out of shape and set in that position. *Be sure the casting is cured.*

Translating Thread Standards—I

AMERICAN STANDARD No. ASA B1.3-1941 on Acme and other translating threads was sponsored by the Society of Automotive Engineers and the American Society of Mechanical Engineers under the procedure of the American Standards Association. It was designated as an American Standard in September, 1941.

This standard covers the design and dimensions of Acme and similar single screw threads intended primarily for translating screws, for which there is a general industrial demand. The designs included have been chosen with the dual purpose of meeting varied needs of the users to the greatest possible extent and at the same time establishing a product capable of economical production. The diameters and pitches have been selected with a view to meeting the present needs with the fewest number of items in order to reduce to a minimum the inventory of both tools and gages. The tolerances are such as to produce complete interchangeability and maintain a high grade of product.

Four series of translating screw threads are included in this standard—the general purpose Acme, the 29-deg stub, the 60-deg stub, and a modified square thread. These screw thread series are intended to cover such applications as lathe dogs and clamps, track drills, steel bench vises, machine tool vises, drill press vises, lifting jacks, steel hand clamps, valve stems, cross feed screws for lathes, letter copy presses, and elevating screws on machine tools and other machines.

The subject of Acme and kindred threads embraces a wide field and it is not possible to combine in a single standard all of the variables of all the uses. The following applications are recognized as common usages, but each has special features which prevent inclusion in a general purpose standard:

1. Feed and leadscrews where backlash or end shake are objectionable.

Table 1 General Purpose Acme Thread—Screws

(Detail dimensions and tolerances for recommended diameter and pitch combinations)

Size	Threads[1] per Inch	Major Diameter		Pitch Diameter		Minor Diameter		Pitch[2] Diameter Tolerance in Terms of Thread Thickness Variation	Helix Angle	
		Max (Basic) D	Min[4]	Max (Basic) E	Min	Max[3]	Min[4]		Deg	Min
1/4	16	0.2500	0.2469	0.2187	0.2087	0 1775	0.1744	0.0026	5	12
5/16	14	0.3125	0.3089	0.2768	0.2668	0 2311	0.2275	0.0026	4	42
3/8	12	0.3750	0 3708	0.3333	0.3233	0.2816	0.2774	0.0026	4	33
7/16	12	0.4375	0 4333	0.3958	0.3858	0 3441	0.3399	0.0026	3	50
1/2	10	0.5000	0.4950	0.4500	0.4400	0.3800	0.3750	0.0026	4	3
5/8	8	0 6250	0.6187	0.5625	0.5495	0.4800	0.4737	0 0034	4	3
3/4	6	0.7500	0.7417	0.6667	0 6537	0.5633	0.5550	0.0034	4	33
7/8	6	0.8750	0·8667	0.7917	0 7757	0 6883	0.6800	0 0041	3	50
1	5	1.0000	0 9900	0.9000	0.8840	0.7800	0 7700	0.0041	4	3
1 1/8	5	1.1250	1.1150	1.0250	1 0060	0.9050	0.8950	0.0049	3	33
1 1/4	5	1.2500	1.2400	1.1500	1.1310	1.0300	1.0200	0.0049	3	10
1 3/8	4	1.3750	1.3625	1·2500	1·2280	1.1050	1.0925	0 0057	3	39
1 1/2	4	1.5000	1.4875	1.3750	1.3530	1.2300	1.2175	0.0057	3	19
1 3/4	4	1.7500	1.7375	1.6250	1 6000	1 4800	1 4675	0.0065	2	48
2	4	2.0000	1 9875	1.8750	1 8470	1 7300	1.7175	0.0072	2	26
2 1/4	3	2.2500	2.2333	2.0833	2 0523	1 8967	1.8800	0 0080	2	55
2 1/2	3	2.5000	2.4833	2.3333	2.2993	2.1467	2 1300	0.0088	2	43
2 3/4	3	2.7500	2.7333	2.5833	2 5463	2.3967	2.3800	0.0096	2	21
3	2	3.0000	2.9750	2.7500	2.7100	2.4800	2.4550	0.0103	3	19
4	2	4.0000	3.9750	3.7500	3.7070	3.4800	3.4550	0.0111	2	26
5	2	5.0000	4.9750	4.7500	4.7070	4.4800	4.4550	0.0111	1	55

All dimensions given in inches.

[1] The selection of threads per inch is arbitrary and is intended for the purpose of establishing a standard.

[2] The length of gage should be equal to the length of engagement which in this case is one and one-half diameters.

[3] Maximum minor diameter of a screw of a given pitch is such as to result in a flat at the root equal in inches to $0.3707\,p - (0.52 \times \text{clearance})$ when the pitch diameter of the screw is at its maximum value.

[4] These dimensions result in tolerances on major and minor diameters equal to $0.05p$.

STARRETT HACKSAWS

IF YOU HAVE BEEN USING HIGH SPEED STEEL BLADES...

Recent government regulations have greatly restricted the supply of 18-4-1 High Speed Steel available for hacksaw blades. To users of this type of blade, we suggest Starrett S-M Molybdenum Special Alloy High Speed Steel Blades as an effective substitute. These tough, fast-cutting blades were developed by Starrett for cutting hard alloys and for metals hard to cut with ordinary blades. In life, performance and all-round cutting ability, they come close to matching 18-4-1 High Speed Steel Blades and because of their lower cost are actually more economical. Convince yourself that Starrett S-M Molybdenum Hacksaws are the blades to use for the duration. Order a trial supply from your mill supply dealer today.

THE L. S. STARRETT CO · ATHOL · MASSACHUSETTS · U·S·A·

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Translating Thread Standards—II

In such applications the nut is tapped first and then the screw is threaded to fit. The screw and nut so made are kept as a pair.

2. Long leadscrews where sagging causes threads to seize. In such applications the major diameter clearance is reduced so that bearing takes place at major diameter before seizing can occur.

3. Assemblies where the thread must maintain some degree of alignment as well as transmit motion. In these applications a reduced major diameter clearance is the most effective and economical means of obtaining satisfactory assemblies.

4. There is a considerable demand in mechanical industries for threaded assemblies which provide faster advance per revolution and which give greater wear surface. The threaded forms covered by this specification are used frequently, incorporating changes in details to meet particular requirements. It is recommended that no coarser thread for a given diameter than those listed be used, but instead that a multiple thread giving the desired lead be adopted. Many applications in the valve industry are typical. Where it is necessary to use multiple threads, the form of single thread corresponding to "crests per inch" of the multiple thread should be used.

In the Acme general-purpose thread the angle between the sides of the thread is 29 deg. The threads are truncated top and bottom, giving a basic depth and thickness of 0.50 of the pitch and are symmetrical about a line perpendicular to the axis of the screw. This series should be used for all Acme thread applications except in special cases where design or operating considerations are such that the 29-deg. stub, the 60-deg. stub or some other modified thread can be employed to better advantage. Basic dimensions of the Acme general-purpose thread are given in Table 3. Detailed dimensions and tolerances for recommended pitches for diameters from ¼ to 5 in. are given in Tables 1 and 2.

Table 2 General Purpose Acme Thread—Nuts

(Detail dimensions and tolerances for recommended diameter and pitch combinations)

Size	Threads[1] per Inch	Major Diameter	Pitch Diameter		Minor Diameter		Pitch[2] Diameter Tolerance in Terms of Thread Thickness Variation	Helix Angle	
		Min	Max	Min	Max[3]	Min (Basic) K		Deg	Min
¼	16	0.2600	0.2337	0.2237	0.1906	0.1875	0.0026	5	12
5/16	14	0.3225	0.2918	0.2818	0.2447	0.2411	0.0026	4	42
⅜	12	0.3850	0.3483	0.3383	0.2959	0.2917	0.0026	4	33
7/16	12	0.4475	0.4108	0.4008	0.3584	0.3542	0.0026	3	50
½	10	0.5200	0.4650	0.4550	0.4050	0.4000	0.0026	4	3
⅝	8	0.6450	0.5805	0.5675	0.5063	0.5000	0.0034	4	3
¾	6	0.7700	0.6847	0.6717	0.5917	0.5833	0.0034	4	33
⅞	6	0.8950	0.8127	0.7967	0.7167	0.7083	0.0041	3	50
1	5	1.0200	0.9210	0.9050	0.8100	0.8000	0.0041	4	3
1 ⅛	5	1.1450	1.0190	1.0300	0.9350	0.9250	0.0049	3	33
1 ¼	5	1.2700	1.1740	1.1550	1.0600	1.0500	0.0049	3	10
1 ⅜	4	1.3950	1.2770	1.2550	1.1375	1.1250	0.0057	3	39
1 ½	4	1.5200	1.4020	1.3800	1.2625	1.2500	0.0057	3	19
1 ¾	4	1.7700	1.6550	1.6300	1.5125	1.5000	0.0065	2	48
2	4	2.0200	1.9080	1.8800	1.7625	1.7500	0.0072	2	26
2 ¼	3	2.2700	2.1213	2.0903	1.9334	1.9167	0.0080	2	55
2 ½	3	2.5200	2.3743	2.3403	2.1834	2.1667	0.0088	2	43
2 ¾	3	2.7700	2.6273	2.5903	2.4334	2.4167	0.0096	2	21
3	2	3.0200	2.8000	2.7600	2.5250	2.5000	0.0103	3	19
4	2	4.0200	3.8030	3.7600	3.5250	3.5000	0.0111	2	26
5	2	5.0200	4.8030	4.7600	4.5250	4.5000	0.0111	1	55

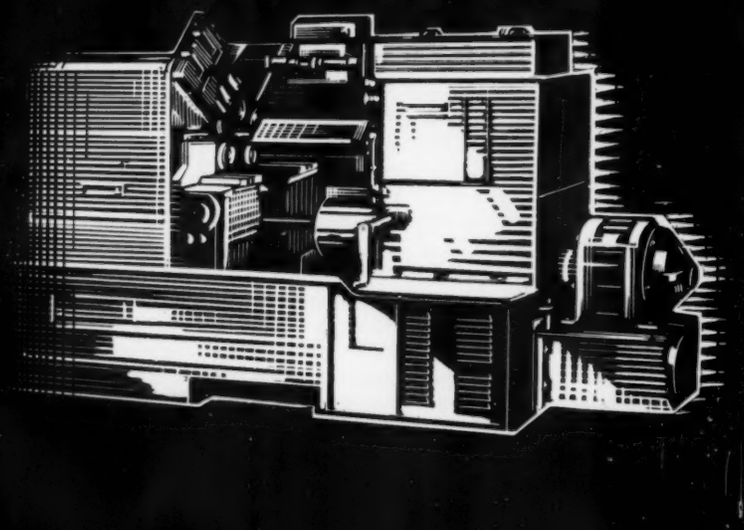
All dimensions given in inches.

[1] The selection of threads per inch is arbitrary and is intended for the purpose of establishing a standard.

[2] The length of gage should be equal to the length of engagement which in this case is one and one-half diameters.

[3] These dimensions result in tolerances on the minor diameter equal to $0.05p$.

Mechanized Warfare . . . on the Production Front



THE still greater speed-up which wartime necessity demands must come from *greater manufacturing efficiency* rather than expansion of plant capacity.

Count on New Britains . . . those now in service or those we are straining every nerve and muscle to ship you at the earliest moment possible. Plan on handing them the toughest production schedule you ever set up. Figure on split-hair tolerance to cut down slow hand grinding and finishing. For "pieces-per-hour" and more production hours a week, New Britains are first in war, first in peace, and first in the hearts of production-minded executives.

NEW BRITAIN AUTOMATICS

A complete line of Multiple Spindle Screw Machines up to 2¼" capacity. Also a complete line of Chuckers, four, six and eight spindles up to 10¼" capacity.

NEW BRITAIN AUTOMATICS

NEW BRITAIN-GRIDLEY

Machine Division • The New Britain Machine Co. • New Britain, Conn.

Mr. Smith Looks at Washington

JOHN SMITH isn't stupid. He is the average American citizen, and he is just as much concerned about our progress in the war as are the bigwigs in Washington who are now in control.

If he were asked for his recommendations to expedite the war effort and to achieve still greater national unity, this would be his reply:

That the government stop treating us like children who are too young to know the facts of life and stop the vicious practice of playing up the good war news and playing down the bad.

That Washington have the courage to go ahead and make all-important war policy decisions NOW instead of waiting until after the November elections.

That one government official instead of three or four speak authoritatively on one subject, thus avoiding repetition of the confusion that has surrounded gasoline rationing from the beginning.

That members of Congress refrain from making reckless and totally inaccurate statements about subjects of which they have no knowledge, such as rubber, their main purpose apparently being to soothe the home folks into thinking that everything soon will be lovely.

That government agencies stop the senseless practice of causing heavy runs on a consumer product by announcing prematurely that it soon will have to be rationed.

That the government stop voicing its endorsement of wage stabilization unless it is prepared to freeze wages as it has tried to freeze prices in an effort to guard against inflation.

That farm blocs and employer blocs and union labor blocs and blocs of any kind whatsoever have no place in our nation, because the only way that we can hope to win this most difficult of wars is to hold steadfastly to the policy of "one for all and all for one."

Burnham Finney

GAGING BUSINESS

Backlog still rises as machine tool output reaches new peak. Sub-contracts are helping equalize load in the industry. WPB will issue new AAA high-priority ratings

Contrary to reports that machine tool builders are "over the hump" in the war production program, backlogs of the industry have risen steadily and sharply since the first of the year. Today the unfilled orders are more than twice the volume on the books at the start of 1942. The industry will be operating at constantly higher peaks during the last half of this year. This development would seem to put an end to talk about machine tool companies taking on the manufacture of munitions as machine tool demand slackens. The point is that there is no sign at the moment of a slackening.

Machine Tool Peak—Production of machine tools in May amounted to 25,700 units valued at $107,300,000. That latter figure represented an increase of almost $3,000,000 over the previous month. Output of metal-working machinery (presses and other machines as well as machine tools) has attained a rate of $1,400,000,000 a year and continues to go up. Considered in dollar volume, May production of metal-working machinery was 80 percent above that in the same month of last year. New orders for machine tools in May were lower than in April, but still were substantially in excess of current output. Little significance is attached to cancellations which have grown lately in size, principally because most of them appear to represent shopping around on the part of buyers to secure better delivery dates.

Pool Orders for '43—Washington continues to place pool orders for machine tools, though it is not so quick to hand them out as it formerly was. It has allotted some pool orders, however, for the first quarter of 1943 and in a few cases is understood to be distributing orders for the second quarter too. With all kinds of orders lumped together, the machine tool industry now has enough business in hand to keep it fully occupied for the next nine or ten months.

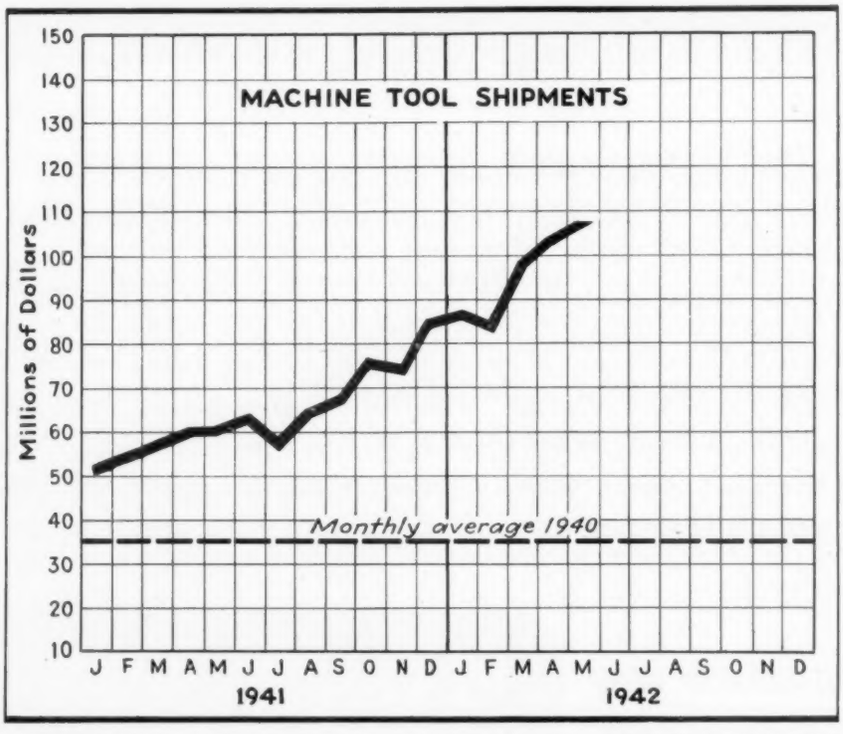
Subcontracts Being Taken—Obviously the load on industry isn't evenly spread out. Some machine tool builders have fatter order books than others. Those companies which aren't so hard pushed are taking subcontracts to make machine tools for other companies. In that way the industry is helping to meet the problem of getting out so-called critical tools as rapidly as possible.

Tools for Russia—Machine tool aid for Russia is being given precedence over almost all other orders. The Soviets are seeking huge quantities of tools to build up further their war industries in areas beyond the Urals which are believed to be safe from German attack. India and Australia also are asking for considerable numbers of machine tools to enlarge their manufacture of munitions and other war implements. Machine tools continue to move to England, but not in as large volume as the British government would like.

Steel Holds—Though the steel rate is down slightly, it still hovers around full capacity. Conversion of more sheet and strip mills to plates has aided the ship plate situation, which is one of the industry's headaches. Conservation of about 275,000 tons of steel annually, or enough to build 30 large cargo ships, is expected from a new Army policy of prescribing wood bodies instead of steel on all cargo body trucks of 1½-ton size and larger. To help relieve the scrap shortage, sponge iron plants are being considered. Over $700,000 has been appropriated by the government to build two pilot plants. They will be erected where they can draw on iron deposits not now being worked, but reasonably near the principal iron and steel centers. If the pilot plants show good results, at least two sponge iron plants, each with a capacity of 1,000 tons a day, will be constructed with private capital. American engineers built two such plants in Japan since 1940.

War Orders Re-rated—New high ratings will soon be assigned to some existing war orders by those agencies which the WPB has authorized to issue priority ratings. New ratings created are AAA, AA-1, AA-2, etc., all of which will take preference over A-1-a ratings. All outstanding AA ratings are automatically changed to AA-2. Thost companies which are now operating under the production requirements plan are specifically authorized to apply or extend the higher ratings which may be assigned to them under the new regulation, but only within the limits of material assigned to them by their PRP certificates.

Shipbuilding—American shipyards set another record in June when 66 new cargo ships and tankers were put into service. The total represents 450 percent increase in production since Pearl Harbor. Contracts for the construction of 28 barges have been awarded to seven shipbuilding companies along the Atlantic and Pacific coasts and on the Great Lakes. Not more than five barges could be awarded to the same contractor. The first must be delivered within 150 days and the last of each five in 270 days.



Still Climbing—Machine tool shipments in May were valued at $107,300,000 with 25,700 units being shipped. In April, first month above the hundred million mark, 25,400 units valued at $103,364,000 were shipped

Two Changes Made in Machine Tool Preference Order

INDUSTRYS TRADE RESOURCES

WASHINGTON—The formation of eight committees in the ordnance field to serve as means for the exchange of information, raw materials, parts and other resources within an industry to secure maximum final production in the minimum time has been announced by the War Department. Industries now covered by the committees include manufacturers of mechanical time fuses, carbines, 37-mm. tank and anti-tank guns, Springfield rifles, .45 caliber pistols, steel cartridge cases, .30 and .50 caliber metallic belt links and .30 Garand rifle clips. Additional committees in other industries will be formed as needed. Each committee operates under the direction of Maj. Gen. T. J. Hayes, chief of Industrial Service, Ordnance Dept., or one of his division chiefs, and is composed of a cross-section of representative plant executives.

Congress Votes $42 Billion Leaves Ship Choice to Navy

WASHINGTON—An Army fund of $42 billion for a force of 4,500,000 men by the end of next year, and a bill of $8,500,000,000 for a "seven-ocean" navy, just voted by Congress for fiscal 1943, bring the total war cost to about $212 billion.

For the first time since 1924 (when Japanese immigration was discussed) the Senate, acting on the Navy bill, cleared its galleries to withhold from the enemy its debate on suspension of further battleship keel-laying. An amendment, to freeze the capital ship program, was defeated and the matter was left to the discretion of the Navy.

Navy Officially Agrees

It was officially stated in the Senate that the Navy is in agreement on stopping the laying down of more battleships. Obviously in the interest of security, the question whether work would continue on capital ships already in progress, was not further discussed in public.

Appropriation for the additional 1,900,000 tons of ships, including 500,000 tons of carriers, now regarded as the backbone of the fleet, brings Navy's total to 5,649,480 tons, by far the world's biggest seapower.

The Army bill, which was raised from a budget estimate of $39,500,000,000 billion, includes funds to buy 23,500 airplanes with spare engines and parts, completing the Air Force share in the Army-Navy total of 185,000 planes to be built in 1942 and 1943.

Many Canadian purchasers, other than service purchasers, were outranked by Foreign purchasers, now rate with them. Listed purchasers will take preference over all others

WASHINGTON—Machine tool preference order E-1-b has been amended, in order E-1-c, and in Interpretation No. 2, making two important changes.

First E-1-b, issued last April 30, apportioned each machine tool producer's monthly output of each size and each type, 75 percent to Service, 25 percent to Foreign and Other purchasers.

This order applied to both the United States and Canada on the same percentage basis. All orders from Foreign countries were given a blanket rating of A-1-a.

Canadian Service purchasers, like Service purchasers in the United States, got their deliveries in accordance with their standing on the Numerical Master Preference List. Service purchasers in Canada, as in the U. S., are prime contractors to army, navy, and shipbuilding.

Canada's Rating Changed

Non-Service purchasers in Canada were grouped with the U. S. Other purchasers, whose deliveries were scheduled in accordance with their individual preference ratings. Thus, many Canadian Other purchasers found themselves outranked preferentially by Foreign purchasers, who were *all* rated A-1-a.

Order E-1-c changes the status of Canadian Other purchasers by giving them a blanket rating of A-1-a, the same as Foreign purchasers.

Canadian Other purchasers are authorized to make notation of this change upon Rating Certificates PD-1, PD-1a, PD-2, PD-3, PD-4 or PD-5, heretofore issued covering purchase of tools by Canadians. This notation should read: "Changed by E-1-c."

There is no change as it affects Canadian Service Purchasers.

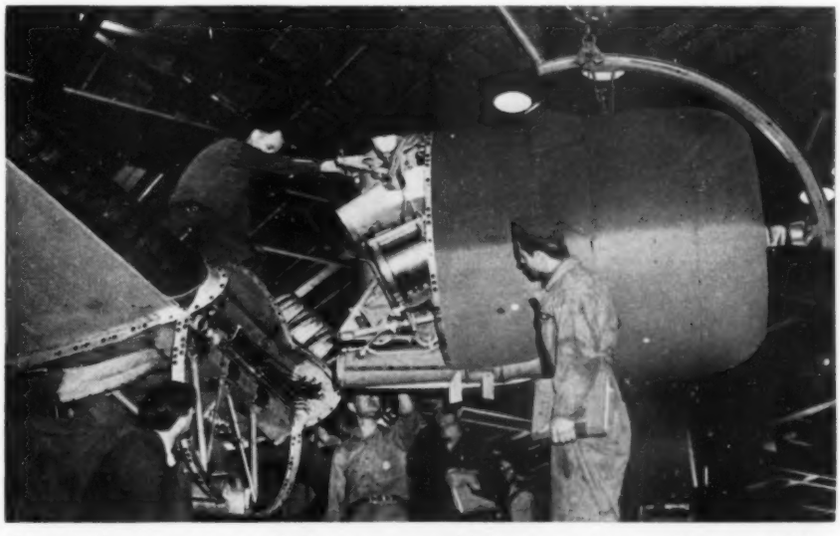
Second, Interpretation No. 2 of Order E-1-b says that machine tool producers should schedule deliveries to U. S. Service purchasers who are on the Preference List, giving them precedence over those who are not on the List, irrespective of the latter's preference ratings.

Listed Buyers Unaffected

Issuance of an AA rating to a non-Listed Service purchaser merely places him ahead of other non-Listed purchasers; he remains subordinate to all Listed purchasers. Issuance of an AA rating to a Listed purchaser makes no difference whatever to him; deliveries to him are determined solely by his position on the List.

Deliveries to be made to two or more Service purchasers, both on the List, and having conflicting delivery dates, will be made in accordance with their standing on the List, whether their preference ratings are the same or different.

A special order can be obtained from the Director of Industry Operations to expedite the delivery date of a tool to a Service purchaser.



Cradle Support—A ardial engine assembly is swung into position on a Consolidated B-24 bomber. The engine is supported from a curved section of track held in a roller mounting. This permits workmen to adjust the engine readily to the proper angle to slip into position against the attaching points

England Finds Draft of Women for War Work Is Essential to Successful War Production

LONDON—The effective use of women is the keynote to successful war production. The Germans realized this many years before war broke out, and planned accordingly; but it was not until the disastrous summer of 1940 that Britain shook off an impression of the "weaker sex" and began a serious utilization of women in industry.

Today it is estimated that more than 4,000,000 of our women have registered for industrial war work. Of these, more than 1,000,000 have already been drafted into war work, and at present 50,000 women are being interviewed and posted each week. The Ministry of Labor is now confident that most semi-skilled and even highly-skilled men can be replaced by women.

Use of Labor Draft

The labor draft recognizes two classes of women: mobile and immobile. All single women are regarded as mobile, and available for transfer to war work in any part of the country where they may be needed. Married women are regarded as immobile and those with children have so far been deferred.

Single women between 20 and 30 were called up first, in age groups. The process of calling up single women of no occupation was quickly completed and it was necessary to transfer them from unessential jobs to war work. Today young girls on comparatively essential work, such as food production and distribution, are being taken into industrial factories and replaced by older women.

Since nearly all single women and childless married women have now been drafted, the Ministery of Labor is extending its demands to include married women with children. As soon as plans for the provision of national nurseries are completed, most young married women with children will also be taken into war work. Married women will generally work 30 hours a week, will leave them time to carry on their housework. Women with husbands in the armed forces are permitted to take up to two weeks vacation on short notice, to coincide with their husbands' leaves.

Training takes place in special courses given in conjunction with technical colleges and employers, and through the Ministry of Labor's training centers. Allowances are paid to the women by the government while they are taking the training courses.

Show Surprising Scope

Many of the aircraft production factories here are now employing staffs which are between 50 and 60 percent women. Many firms report that some departments are staffed entirely by women. The scope of the work they are doing is surprising. Aside from obvious light duties, such as drafting, machining, clerical, there are now large numbers of women doing truck driving and maintenance, crane driving, railway shed work, boiler work, fixture work, general and specialized assembling, aircraft detail fitting and many forms of electrical work. They are also being trained in large numbers for both arc and gas welding.

For some time women workers' wages were considerably below those of men. Now that it is being proved that they can do many jobs just as efficiently as men, they are beginning to earn almost the same money. The increase in their wages since 1938 is estimated at 42 percent.

Price Ceiling Revised On Machines and Parts

WASHINGTON—An extensive revision of the much-postponed price ceiling Order 136 on machines and parts has been made which will take effect on July 22. Machine tools, however, are not covered by this order issued by OPA.

A comprehensive list of machinery on which prices shall not exceed those of October 1, 1941 is included as well as a list of that which shall not be sold above March 31, 1942 levels, and a list of machines not covered by this order but which are under the general maximum price regulation or other OPA orders.

Spitfire Nurse—Girls who formerly were domestic servants, salesgirls and housewives have become trained to repair damaged fighter planes at this English repair factory

INDIA COMES THROUGH

LONDON — Industrialization is making rapid strides in India according to a report recently made to the *Manchester Guardian*. Plants in that country are now producing a large variety of special steels, including an alloy of steel for aircraft, a high-speed steel for machine tools, nickel steel plates and acid open hearth steel.

More than 1,500 workshops are now producing munitions, including the Bren gun. Aircraft frames are being made and aircraft is being assembled. A new motor assembly plant has been set up by Americans to furnish cars to Russia.

For the first time some simpler types of machine tools and machinery are being made in India. All railway equipment is also now being manufactured in that country.

Steel Wage Rise Case Gets War Labor Board Hearing

WASHINGTON—Now in hearings before the War Labor Board is C.I.O.'s demand for $1 a day increase in wages plus "maintenance of union membership" from Little Steel—Bethlehem, Republic, Youngstown Sheet & Tube and Inland Steel.

This case is important in that it will test the prestige and authority of the new board, and tell whether the anti-inflation, "freeze wages" policy of the government can stand up against the pressure of labor for a better standard of living.

The steel employers say that their workers are already better paid than those in other war industries. C.I.O. says the steel workers' standard of living has declined on account of rising costs.

A three-man panel from the board received the case first. The panel has reported in favor of the $1 increase and union membership maintenance, which means that members must stay in during the life of a contract or the employer must fire them. Now the case is in hearings before the board as a whole. The board's decision will be a "directive" which is not an order, not compulsory. Either side can refuse to abide by it, but such refusal would make the public sore, and the President probably would take the plants in the name of the Army or Navy.

Thurman Arnold Heads Drive to Change Patent Laws

Bill now before Senate Patents Committee would permit the administration to take over any patents in the public interest, would prohibit pooling and cross-licensing

WASHINGTON—Almost unnoticed in the uproar of war a new drive is under way to revise the nation's patent laws. Bills have been introduced, under the aegis of Thurman Arnold, chief of the antitrust division of the Department of Justice. These bills are in hearing before the Senate Patents Committee. It is assumed, even by proponents, that the bills will be rewritten.

At present the President has authority to take control of any and all patents as property affecting war production. In broad terms, Arnold and his collaborators propose to authorize the administration to take over any patents in the public interest whether they are related to the war or not.

Avoid Invalidation

They further propose (1) more stringent requirements so that patents will not be issued which will later be invalidated by the courts; (2) that government agencies may call in question any patent, whereas at present only the owner can cause a patent to be tested in an infringement suit; (3) prohibition of pooling or cross-licensing except to avoid a bonafide patent deadlock; (4) compulsory licensing under all patents for reasonable royalties; (5) prohibitions against restrictions in licensing as to price, territory and use; (6) that all patent agreements be registered publicly; (7) measures to prevent "the use of infringement proceedings never brought to trial simply to coerce persons to recognize alleged patents, patents of questionable validity."

No War Measure

These recommendations are substantially the same as those made by the temporary National Economic Committee several years ago. The Patent Office administration and business opposition to Arnold's program say that then, in peace, was the time to try this issue, not now. Chiefly, the Patent Office and most businesses interested in patents believe that the reward stimulus toward invention should be maintained. Mr. Roosevelt himself seemed to express the feeling in his planning commission order that the government itself might take a hand in the rewards.

Arnold's proposals cannot be a war measure, they say, because the President has authority to seize any and all patents, both domestic and foreign, and he has seized many valuable foreign patents. The committee, it is affirmed, has shown no case of withholding since Pearl Harbor. And in normal times, they further argue, patents are withheld only because the product is unacceptable on the market or because some competitive product is better.

Concerning the charges against various companies for making cartels on foreign patents, to the detriment of the war effort, the opposition to Arnold points out that had not American companies bought and paid for the foreign patents and produced the goods, we would have been without it, as we were without the German's dye making skills in the previous war.

Only three or four senators are seriously interested in the present campaign, and it is hard to imagine that Congress will take any decisive action in the near future. But the matter will bear watching.

Machine Tool Star—J. Y. Scott, president of the Van Norman Machine Tool Co. converses with James Forrestal (center), under secretary of the Navy, and Al Tlusty (right) president of the CIO local at Van Norman after the firm had received the Army-Navy Star for outstanding machine tool production

NAME LYCOMING PLANT HEAD

CLEVELAND—William B. Griese, plant manager of the Lycoming Div., Aviation Corp., has been made plant manager of the company's Liquid Cooled Engine Div., according to William F. Wise, executive vice president. The new division will build a larger liquid-cooled engine for the Navy than any liquid-cooled aircraft motor now in production. Mr. Griese became associated with Aviation Corp. in Feb. 1941, having been with Crosley Corp. for seventeen years, recently as plant superintendent. He will be succeeded at Lycoming by M. I. Bradley, works manager.

Van Norman and Baush Receive Army-Navy Star

SPRINGFIELD, MASS.—The Van Norman Machine Tool Co. and the Baush Machine Tool Co. were presented Army-Navy Star awards by Undersecretary of War Robert P. Patterson and Undersecretary of the Navy James Forrestal on June 20. The blue burgees with white stars which the two companies received marked their outstanding contribution to machine tool output in the war program.

In addition to Judge Patterson and Mr. Forrestal, the speakers included J. Y. Scott, president of Van Norman; George D. Haskell, president of Baush; and A.F.L. and C.I.O. union leaders. Mayor Roger Putnam of Springfield was the master of ceremonies.

"Machine tools are the foundation on which our production structure is built," said Judge Patterson. "American machine tool men are doing a stupendous job. Machine tools are now being turned out at a rate of $1,380,000,000 a year. Machine tool designers have worked to improve tools so much that machine tool effectiveness today is one-third to one-half greater than it was in 1930. Our production today is 16 times what it was—in capacity to cut metal—at the peak of the World War."

CANNED FOOD TO PLYWOOD

PITTSBURGH—Large scale production of airplane parts from plastic bonded plywood will be started shortly in some of the plants of H. J. Heinz Company, which normally produce canned foods. After a study of its factories the company found that some of the equipment is immediately adaptable to specialized work, particularly the manufacture of aircraft parts of plywood.

President Releases May War Production Figures

WASHINGTON—Nearly 4000 airplanes produced in May, as announced by the President, brings the monthly rate almost up to the annual rate of 4500 in May, 1940, when Mr. Roosevelt called for a production rate of 50,000 planes per year.

Following the President's production statement the other day, the Aeronautical Chamber of Commerce pointed out that the aircraft industry had increased its annual production by 1000 percent in 25 months. Col. John Jouett recalls that the rate in September, 1939, at the outbreak of the war, was only 3000 per year, and that now it is 48,000, only 2000 short of the President's requested 50,000.

Also, in May, Mr. Roosevelt announced, we produced 1500 tanks, and nearly 2000 artillery and antitank guns, exclusive of AA guns and guns to be mounted on tanks. In that same month, he said, we built 50,000 machine guns of all types, including infantry, aircraft, and anti-aircraft, but not including submachine guns. If we add those, the total is over 100,000. The President emphasized that all this is for one single month.

But he warned against optimism, saying we need more and more. And he said there are plenty of serious production problems ahead, particularly shortages of materials.

Canada's New Wealth-Conscripting Budget Leaves Taxpayers Nothing But Patriotism

New taxes will go as high as 98 percent; excess profits taxed 100 percent

OTTAWA—Service to the national interest is the only incentive remaining to Canadian industry following Finance Minister James Lorimer Ilsley's new wealth-conscripting budget. In stern determination to maintain the war-finance policy of "pay-as-you-fight" as far as possible Ilsley has removed the profit motive from business by 100 percent excess profits taxes and personal income taxes which take as much as 98 percent of top incomes. Under the new taxes the Treasury gets from companies either 40 percent of all profits or 30 percent of all profits and 100 percent of excess profits, whichever is the greater. In effect a company will turn over anything but 70 percent of standard profits (average profits for four pre-war years). The new personal income taxes have a deeper effective impact than President Roosevelt's proposal for a $25,000 ceiling on income. In order to have $25,000 for himself under these levies a Canadian would have to have an income before taxes of between $200,000 and $300,000. Out of a $100,000 income he would retain only $21,000; out of $500,000, only $37,000.

Compulsory Savings

But to offset the severity of his taxation Ilsley has inaugurated the policy of compulsory saving for both companies and individuals. Companies paying at the 100 percent rate on excess profits will have 20 percent of their profits returnable after the war to help them readjust to peacetime operations. It is to be returned without interest within two years after cessation of hostilities. Forced savings for individuals amount to 8 percent of income of single persons and 10 percent for married persons plus 1 percent for each dependent, with a ceiling of $800 for single persons and $1,200 for married persons with children. These savings, also returnable after the war, will earn 2 percent interest. Total income taxes which include the forced savings are deductable by the amount of voluntary savings of the taxpayers in life insurance, mortgage principal payments on a dwelling and payments into pension or retirement funds connected with employment.

Taxes Are Doubled

To make sure that both companies and individuals will hand over their tax money before they have a chance to spend it, Ilsley has adopted a pay-as-you-earn policy. Companies are required to pay in monthly installments, estimating payments on the basis of the previous year's earnings and the current year's tax rates. Taxes of individuals are to be collected at the source as they earn wherever possible. Employers are made responsible for deducting installments of taxes from wages and salaries of employees and remitting the proceeds monthly. At the end of the year they will have to show the amounts to be credited to each employee. Deductions are to be reduced by the amount of voluntary savings up to the total of forced savings. Where personal income is not deductable at the source it has to be paid in quarterly installments.

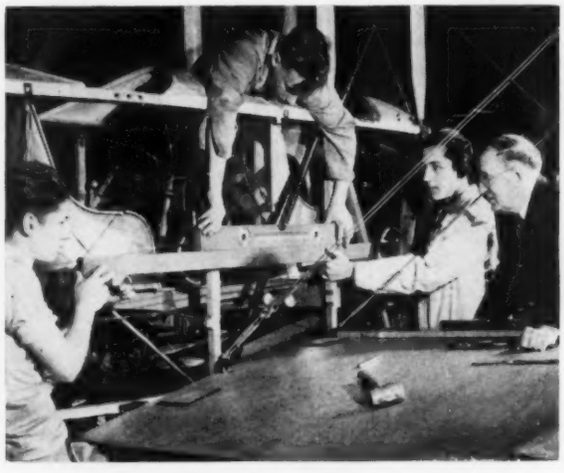
The new rates increase personal income taxes by almost 100 percent in some lower brackets and by a third to a half in higher brackets. The former exemptions of $750 for single persons and $1,500 for married persons are flattened to a common exemption of $660 for both. But for part of the tax at a flat rate single persons above $660 total income and married persons above $1,200 pay on everything, the exemption applying to a graduated tax which comes on top of the flat rate tax. A married person is allowed a deduction from the tax payable of $150 with $28 deduction for each child under the flat rate tax and $80 under the graduated tax.

Custom Duties Removed

Prior to the new budget companies paid an 18 percent corporation income tax on all profits and either an additional 22 percent on all profits or 75 percent on excess profits which ever was greater.

An exemption from company and personal income tax for outlaying on mining development up to $5,000 is withdrawn from gold and silver mining but continued for base metals and extended to vital non-metal mining.

The budget removes customs duties from machinery for exploiting oil-sands, fuel injection pumps and nozzles for diesel engines.



Start Them Young—These Canadian youths will soon graduate as airframe mechanics. As they become of age many will be recruited into the Royal Canadian Air Force

INSIDE DETROIT

War contractors are not taking full advantage of working capital loans guaranteed by the government. War shipments from 432 plants reported up 46 percent in two months

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT — Munitions manufacturers, especially subcontractors, have not taken full advantage of working capital loans available under Executive Order 9112, dated March 26, and Federal Reserve Board Regulation V, effective April 26.

Any contractor or sub-contractor to the War Dept., Navy Dept. or the Maritime Commission is eligible for a government-guaranteed loan to alleviate working capital shortages. Application for the loan can be made to any commercial bank. The government will guarantee 90 percent of the loan value: maximum interest rate is 5 percent, including ½ percent for loan insurance. Obviously, the terms are attractive to most commercial banks, which risk only 10 percent of the loan value. For example, if a concern borrows $100,000 for a two-year-period, at say 4 percent interest, the bank hazards $10,000, receives in return $7,000 in interest, after deducting government loan insurance.

The services are moving to expedite such loans to war contractors. The War Dept., for example, has established an Advance Payment and Loan Section, Service of Supply, Washington, in which has been centered the administration of powers conferred under Executive Order 9112. In order to facilitate dissemination of information and *to expedite arrangements for loans,* the Materiel Center of the Army Air Forces, Wright Field, has established a Financial Section in each of the Procurement Districts.

By applying for a guaranteed loan to any bank, whether a member or not of the Federal Reserve System, the munitions producer establishes a channel of credit which is limitless, compared to normal banking practice, and he can proceed with a several-fold increase in munitions production. This is in marked contrast with the predicament of the subcontractor, for example, who has reached the limit of his normal credit resources, and can get no further working capital than the advances made to him by a prime contractor upon a specific undertaking.

Instances can be cited of small concerns that will achieve a manyfold increase in production during 1942 by overcoming capital shortages through these guaranteed loans. A family concern did $235,000 in 1940, will gross $1,500,000 this year through the medium of a $300,000 loan to handle costs of materials, plant facilities and engineering research. Two partners organized a small company in 1940, grossed $40,000 in 1941, will hit $250,000 in 1942 as the direct result of a $20,000 loan, although their peak this year through normal credit channels would have been $50,000 worth of business. Make no mistake, if the service or product of war producers is desperately needed and they have ability, but lack capital, the Financial Section, Central Air Corps Procurement District, at least, will welcome an opportunity to talk things over.

War Shipments Jump

War shipments from 432 plants of 157 companies, which make up 72 percent of the automotive industry (based on labor), were 46 percent greater in April than in February, a report made today by the Automotive Branch of the War Production Board showed. The 157 companies included eight large automobile manufacturers, nine truck companies and 140 parts companies.

These companies reported April shipments of $420 million, of which 83 percent were war goods. War shipments increased from $239 million in February to $349 million in April. Non-war shipments declined from $145 million to $72 million, or a decline from 60 percent to 20 percent of war shipments of the corresponding months.

Thus the April shipments of war goods from these companies (72 percent of the industry) was at an annual rate of more than $4 billion (which would

AUTO WORKERS KEEP SENIORITY

WASHINGTON—The government's automobile industry labor transfer policy has been amended by joint action of the War Manpower Commission and War Production Board in order to facilitate employment of trained workers at their top skills. The statement directs that workers originally from non-war plants who have been fully trained by the new employers for new jobs may stay with their new employers if they choose, retaining their accumulated seniority rights, unless their former employers offer them jobs which will utilize their newly acquired skills. Under the former policy a former employer could recall a worker to his original job on one week's notice and if he did not return he would lose his accumulated seniority rights. This had the effect of disrupting essential war occupations in the new plants.

To The Last Bolt—These Army Air Force ground troops are learning how to tear down, overhaul and rebuild Buick aircraft engines. Enrollment in the school has been doubled in recent weeks. Although several hundred mechanics are turned out monthly there have been no failures yet

be at the rate of more than $5,600,000,000 for the whole industry).

In the 432 plants, which employed 561,480 persons in April, of whom 413,656 were production workers, man hours increased from 65 million in February to 104 million in April. Of the 39 million increase, 36 million of it was on war work, which went from 39 million man hours in February to 75 million in April.

Thus man hours on war work were 92 percent greater in April than in February. In April, war work comprised 72 percent of the total man hours in these 432 plants, as compared to 60 percent in February. The 75 million man hours on war work in April was at an annual rate of 900 million or two-thirds of the way toward the man hour peak, as compared to approximately 30 percent in February.

WAR ORDERS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ALLOY STEEL SCRAP—Mandatory segregation by classifications to conserve this material to permit reuse has been ordered. (Supplementary Order M-24-c.)

ALUMINUM—Reductions in prices of fabricated aluminum products has been postponed until August 1, 1942.

ALUMINUM SCRAP—Persons buying and selling aluminum scrap on an "as is" basis are running the risk of being liable to heavy penalties provided for violation of Revised Price Schedule No. 2.

AIR CONDITIONING—Amendment to afford some relief from restrictions originally imposed on manufacturers and distributors of industrial and commercial refrigerator and air conditioning equipment makes provision to permit sale of certain items of equipment listed under paragraph (e) of the order without necessity of obtaining a preference rating to cover installation of the finished product. (Amendment 1, Limitation Order L-38.)

CADMIUM—Delivery to distributors and to users may be made only upon specific authorization by WPB. Users of cadmium must obtain authorization by filing Form PD-441 before delivery can be made or accepted. (Preference Order M-65.)

EXHAUST VALVES—Rigid specifications for manufacture of this item used in all types of automotive equipment to conserve large quantities of chromium and nickel have been established. (Limitation Order L-128.)

HAND SERVICE TOOLS—Industrial hand files have been added to this list. (Amendment 1, Preference Order E-6.)

INSPECTION EQUIPMENT — No gage, precision measuring tools, testing instruments or chucks may be sold except pursuant to rating of A-10 or higher. Also certain specific types of gages, tools and instruments costing more than $200 may not be purchased except by preference rating certificate or order of the P-19 series. (Preference Order E-5.)

IRON AND STEEL—Changes have been made in the original price schedule for the purpose of clarifying portions as well as for making available information regarding processing and conversion charges. (Amendment 6, Revised Price Schedule 6.)

IRON AND STEEL SCRAP—The addition of several new grades and provision for changes in specifications for certain grades have been announced. (Amendment 6, Revised Price Schedule 4.)

MACHINE TOOLS—Blanket preference rating of A-1-a has been assigned to machine tool orders of certain Canadian purchasers. Preference Order E-1-c.) AA ratings should not be sought to expedite delivery of machine tools to "service purchasers." (Interpretation 2, Order E-1-b.)

NICKEL SCRAP — Changes have been made in the order covering this material to make it conform to the new alloy steel scrap segregation order, M-24-c. (Amendment to Supplementary Order M-6-c.)

REPORTS—Special reports on Form PD-25G will not be required from companies operating under Production Requirements Plan after the June report.

PIG TIN—Sale of certain metal produced by the electrolytic process at a price equal to that of the top grade of tin is permitted. (Amendment 2, Revised Price Schedule 17.)

VANADIUM—Melting and delivery of any amount over 10 lb. per month has been placed under complete control. (Amendment to Preference Order M-23-a.)

Continental Rewarded

In recognition of the part played by Continental Motors in mass producing the smaller sizes of radial aircooled engines for light and medium tanks and for training planes, Continental Aviation & Engineering Corp., a subsidiary, has been awarded a plant facilities contract calling for manufacture of yet another aircooled motor under license. Continental Motors has exhausted the production possibilities of two existing plants, what with projected expansion programs, making it necessary for Continental Aviation to supervise the new program in a new structure. The main building will be the largest wood-truss structure built in Michigan in many years.

It will be recalled that Continental Motors recently offered voluntarily to reduce the price of engines on the balance of outstanding contracts, the government to benefit by approximately $40 million. Yet in 1939, Continental had been forced to close one plant, was waging an uphill battle to get its motor accepted for light tanks, had to go into production with elderly machinery. Production quotas eventually were lifted beyond existing capacity, new equipment was added. Meanwhile, the closed plant was re-opened and completely retooled to make power plants for medium tanks. By hard work and initiative, and making the most of available facilities, Continental Motors put across its own engines for light tanks, then undertook manufacture of another make under license for medium tanks, and now has been asked to produce a third type of radial aircooled engine.

Lodge & Shipley Makes New Sales Agent Appointments

CINCINNATI—Arrangements have just been completed by the Lodge & Shipley Machine Tool Company with four companies to serve as agents in the New York and New England territories to handle the sale of its lathes and Duomatics.

Wilson Brown Co., 5200 Chrysler Bldg., New York City, of which Dan Harrington is manager, will cover the eastern section of New York State, northern New Jersey and the entire state of Connecticut. The C. H. Briggs Machine Tool Co. of Syracuse will handle the central area of New York State and northeastern counties of Pennsylvania, and the Buffalo and Rochester areas will be handled by the George Keller Machinery Co. of Buffalo.

The General Machinery Corp., 140 Federal St., Boston, with John Tierney as manager, will serve the states of Massachusetts, Rhode Island, Maine, New Hampshire and Vermont.

WARTIME WASHINGTON

Impending reshuffle of WPB indicates that it has done the major job for which it was set up. Orders for heavy cargo gliders make use of air freight "trains" probable

BY BLAINE STUBBLEFIELD

WASHINGTON—If the War Production Board has not been reorganized by the time you read this it probably soon will be.

WPB has completed setting up production machinery and channeling procurement. The Board's job was to act as umpire between civilian and war needs while the public was getting into the mood for war sacrifices; to apportion war production between the Services, and to do a production promotion job which the military men were not equipped to do.

Now, production is rolling. Army and Navy appear ready and able to take over many functions of keeping it rolling. The reshuffle is all to the credit of the Board for what it has accomplished—not on account of what it failed to do.

WPB will retain control over raw materials, because there never will be enough and what there is must be stretched and apportioned among our own Services and the United Nations. Thus Nelson's position becomes similar to that of Capt. Oliver Lyttleton in the British Ministry of Supply, with several deputy administrators.

Luther Gulick was called over from the National Resources Planning Board weeks ago to advise him on simplification and decentralization of broad administration of WPB. Gulick had a hand in reorganizing the government in 1939 and last spring he helped to set up the new three-power Army: Air Forces, Ground Forces, and Services of Supply.

Some WPB officials have opposed the Army-Navy taking over procurement because they fear that the military might eventually exercise undue control over civilian life and economy. But the Constitution provides against that by making a civilian the Commander in Chief; the military cannot get control so long as the President doesn't want it to.

Presumably it was Army which proposed the warranty stamp plan for the distribution of machine tools and other vital equipment. This plan was twice rejected by the Board, which later issued Order E-1-b instead. But sponsors of the stamp plan are still pushing it.

Cost-Plus Contracts Stay

Opinion here is that the War Department probably will block legislation to prohibit any further cost-plus-fixed-fee contracting. Chairman May of House Military Affairs says in reply to the proposal that all work would take longer and might cost even more. Army doesn't like the extra costs incurred by rush to get war plants and other jobs done, but the alternative, lump sum contracting, means that jobs must wait for detailed specifications to be put in the hands of contractors, and the contractor's price will include some padding against risks anyway.

Gliders for Air Freight

Army has suddenly ordered production of training and heavy cargo gliders. Many aviation men were surprised at this when they recalled that only three months back, both Services testified before Congress that gliders would not be important in American strategy.

The answer is air cargo. Army's first move, when the shipping shortage became serious, was to order an air-borne cargo program, rushing production of current models for the present, and of bigger planes in about two years.

Army's second air cargo move is to call for a large output of gliders and glider pilots.

Look Out Laval—A contingent of Free French Workers at an aircraft works "somewhere in England" joyfully build the planes that will help to liberate their country. Here they are putting the finishing touches on an engine installation

AN ORCHID FOR TRACTOR

WASHINGTON — A large orchid was tossed by Donald Nelson to the Cleveland Tractor Company, of Cleveland, in the public announcement that the company has achieved an increase of 63½ percent in production, one of the greatest since the start of the war production drive. In March, the Company had the greatest production in its history; in April it was 23 percent over March; and in May it was 33 percent over April, or 63½ percent over its start in the drive.

This resort to "powerless" transportation was put off so long for no worse reason than that human foresight is short. For years, engineers have known that a given aerial power plant would haul about four times the load, distributed among tow-plane and gliders, as a single big plane with the same power plant could haul.

This means that a DC-3, for example, which might be carrying 6000 pounds of pay load, could pull one, two, three, or more gliders, with 24,000 pounds of freight distributed on itself and the gliders. Of course the speed would be less.

AMERICAN MACHINIST has learned, but cannot publish, the specification of very large cargo and troop-carrying gliders now on order. They will be built almost entirely of non-strategic materials, and in non-war plants.

All-American Aviation, the du Pont air mail pickup system, and Wright Field, Air Force flight laboratory, have developed a device which enables tow-planes to grab gliders off the ground without landing. A hook catches the glider's line, and a reel in the tow-plane pays out line, gradually tightening as the glider gathers speed.

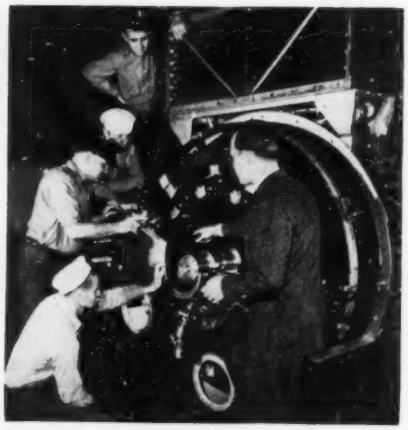
As yet, no air train "locomotive" has been publicly announced but it will come in time. It will be mostly power plant, like a harbor tug.

Air freight glider lines after the war are expected by many creditable authorities, but no one can say what problems may come up. It sounds good for passengers. A glider is quiet and vibrationless as a sail boat.

A glider train is arranged in V formation, by separate tow-lines, so that any unit can cut loose at its destination while the train goes on.

Glider trains can not yet cross the ocean, but they can range United Nations overland supply lines.

One of the glider's advantages is that it can land almost anywhere, by nosing over on its skids and stopping quickly.



Keep 'em Running—An instructor explains details in a bearing housing to Navy men being trained in the maintenance of submarine propulsion equipment at a G. E. School

Men Trained to Maintain War Devices in the Field

NEW YORK—A training program is being conducted in several General Electric plants to teach military men and company employees how to maintain many of the new and highly technical war devices in the field. In the majority of courses teachers are being trained who will go out and train others. Electrical machines and circuits must be coordinated with highly complex mechanical mechanisms, optical systems and radio.

Smaller courses are under way at a number of navy yards, air fields and aircraft factories. The first graduates of a course in the use of aircraft locators which General Electric organized for the navy are now in the fighting areas. A similar course is being organized for the army at another plant. In space once used to store home appliances an aircraft armament school is in progress. Many Canadian and British as well as United States army and navy men are being trained in some of the courses. All the courses are a combination of theory and practice with the students learning the complete assembly and disassembly of the device studied. Specially prepared texts, charts and motion pictures frequently supplement oral instruction.

Reduce Packing Space

WASHINGTON—Experiments by the Services of Supply are under way to reduce the bulk in packaging items shipped overseas. Army predicts a cargo space saving of about 10 percent. Machine guns are being shipped two to a box, saving 35 percent of space over the former one to a box. Airplane wings, formerly shipped edgewise are now packed flat.

Women Supervisors Get More Work Out of Women Workers, Chicago Meeting is Told

Experience of plants which are using women workers is studied in panel meeting

CHICAGO—War production manufacturers employing, or about to employ, women in shop work received valuable pointers in answer to questions posed at a lively discussion held June 23 under the auspices of the Illinois Manufacturers' Association.

Women supervisors may not be well liked by the woman worker, but they get out more production from the girls than do the men supervisors it was pointed out by Ruth Stone of Western Electric. She said it was true that women don't like to work for women, and that the women supervisors take themselves too seriously, try too hard, and are a little too severe. Nevertheless she was for them because they get more production out of women workers than do male supervisors.

Effect on Morale

Surveys showed that many more supervisors were needed in the International Harvester plants, Miss Sara Southall reported. "So we went to the plant where we had the largest number of women, and from them we made selections to develop supervisors," she said. "First we took girls who had been in two or three lines of work—assembly, inspection, and operating machines. Then we tried to find those with another element—that of the natural leader, quick to catch on, popular with others, and good at getting along with foremen. Practically all of these selected had a high school education. We picked ten for intensive training. These first women supervisors later helped develop others."

Discussing the effect on morale when women are injected into a plant, Miss Southall stressed the point that foremen and women supervisors must maintain very strict discipline from the start. She pointed out that if in a small distant town, or a suburb of Chicago, some gossip gets started after girls are employed parents will say: "I don't want my daughter to work in that plant."

Another point made out of Harvester experience was: If you are putting women into your plant for the first time, and are going to operate with them on a piece-work basis, get a time-study man experienced in setting piece rates for women, to set their rates; for women are so clever and fast in repetitive operations that otherwise you may find yourself paying them more than skilled machinists and tool makers can earn.

Tops on Small Assembly

R. W. Mathers of Stewart-Warner said that while it was almost treason toward men for him to agree to the facts, it is true that women are excelling in the repetitive machine jobs. He said: "They are more careful, do less playing around, and mohotony does not bother them, probably because they have been used to knitting all day long. In operating automatic screw machines, turret lathes, and grinders—any machines not calling for operators of marked physical strength, for us the women are doing well, and on small assembly jobs they are tops."

Mr. Mather said that if there are no difficulties at home, such as children not properly cared for, married women are better than single women, that they are absent or tardy less, accept responsibility better, and "probably get more sleep."

No Weight-Lifters

Miss Stone said one thing you have to eliminate for women is the requirement to stretch in reaching up and to lift excessive weights. Miss Southhall said that International Harvester, in planning to use women on welding, was providing platforms. She added: "The standard in England says it is all right for a woman to lift one-third of her own weight. For a 100-pound girl that would mean 33 1/3 pounds. I hope we here won't have to come to that." Later she advocated starting at letting them lift not over 10 or 12 pounds.

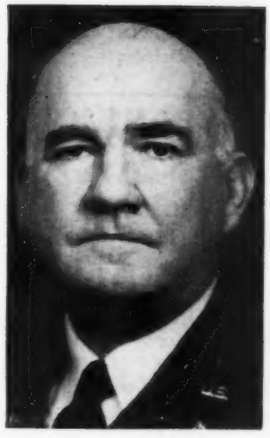
Referring to the National Safety Council's crusade against high heels for factory girls, Miss Stone said a current style is worse—shoes without toe caps. She said toes sticking out of shoes pick up bits of wire, borings and other things causing injury and should be banned.

"What to do about girls who appear in anklets or without stockings?" was the climax question. Miss Southall called attention to the point that if the girls wear slacks it makes no difference, and that now some of the stockingless girls are so fixed up that you can't tell whether they are wearing stockings or anklets or only shoes. "If you can't tell," she said, "why worry?"

STREAMLINED TANKS?

WASHINGTON — Streamline designers at last have broken into weapons. George W. Walker has been retained as consultant to General Barnes, ordnance research chief, to make studies of ballistics and contours of the Army's vehicles. It is said he will try to turtleback the tank, to ricochet any projectiles that hit it.

Officers Who Take Up New Duties at Ordnance Posts



C. T. HARRIS

R. W. CASE

H. C. MINTON

U. S. Army Signal Corps

A. B. QUINTON

Many Ordnance Department Promotions and Changes

WASHINGTON—Four promotions have been made in the Ordnance Department to the rank of Brigadier General. Those who have been advanced are Donald Armstrong, who is deputy chief of the Chicago district. Advancements in the Ordnance office include Gordon M. Wells, chief, Artillery Division; John K. Christmas, chief, Tank & Combat Vehicle Division; Rosswell E. Hardy, chief, Ammunition Division.

As previously reported other Ordnance Department changes include the appointment of Maj. Gen. Charles T. Harris, Jr., as commanding officer of the Aberdeen Proving Ground at Aberdeen, Md., to succeed Brig. Gen. Rolland W. Case at that post who has assumed new duties in the office of the Chief of Ordnance; Brig. Gen. Burton O. Lewis has been named Deputy Chief of the Boston Ordnance District; Brig. Gen. Hugh C. Minton has become Deputy Chief of the Pittsburgh Ordnance District; and Col. Alfred B. Quinton, Jr. has become Deputy Chief of the Detroit Ordnance District.

New Agents for Cincinnati Bickford in N. Y. and N. E.

CINCINNATI—To handle the sale of the Cincinnati Bickford Tool Company line of radial drills, upright drills and jig boring machines in the New England and New York territories several agents have been appointed. The Wigglesworth Machinery Co., 199 Bent St., Cambridge, Mass. will cover the New England states, while eastern New York State and northern New Jersey will be handled by the Rudel Machinery Co. with offices at 200 Fifth Ave., New York City. L. H. Pratt, W. O. Graham and Frank Hamilton who were formerly with Henry Prentiss & Company are associated with the company.

The central New York and northeastern Pennsylvania territory will be taken care of by C. H. Briggs Machine Tool Co. of Syracuse, N. Y. with C. H. Briggs as president of the firm.

George Keller Machinery Co., 1807 Elmwood Ave., Buffalo, N. Y. has been appointed agent for the western New York territory, including Buffalo and Rochester. E. F. Morgan and J. A. Carter, who were also formerly associated with the Prentiss organization are now affiliated with the Keller Company.

Washington Appointments

War Production Board:

Charles F. Kettering, consultant to Radio and Radar Branch.

WPB, Division of Industry Operations:

Fred Lavis, Jr., Chief, Foreign Requirements Branch, Bureau of Priorities.

Presiding Officers of Advisory Committees:

Francis R. Kenney, Brass Mill Industry, Copper Wire & Cable Industry.

Andrew Leith, Ferro-Chromium Producers Industry.

Harold C. Hopper, Motion Picture Theatre Equipment Manufacturers Industry.

W. W. Timmis, Temperature & Combustion Control Industry, Cast Iron Boiler and Radiator Industry.

War Manpower Commission:

Edward C. Elliott, Chief, Professional and Technical Employment and Training Division.

Lieut. Col. Sam. Seeley, Chief, Office of Procurement and Assignment Service.

Leonard Carmichael, Director, National Roster, Scientific and Specialized Personnel.

John J. Corson, Chief, Industrial and Agricultural Employment Division.

Lieut. Col. Clinton Roy Dickerson, Chief, Military Division.

William Haber, Chief, Planning and Progress Reports Division.

Frederick F. Stephan, Chief, Statistical Analysis and Coordination Service.

Robert C. Weaver, Chief, Negro Manpower Service.

Will W. Alexander, Chief, Minority Groups Service.

Harold Dotterer, Chief, Administrative Services.

Office of Defense Transportation:

Horace M. Wigney, Chief, Refrigerator Car Section.

Office of Price Administration:

Charles F. Phillips, Director, Automotive Supply Rationing Division.

Ben W. Lewis, Special Representative and Consultant to Deputy Administrator.

Robert F. Bryan, Price Executive, Rubber Price Branch.

Labor Policy Committee:

I. M. Ornburn, AFL; Emil Rieve, CIO; T. C. Cashen, Railway Labor Organizations.

NAMES in the NEWS

Lester F. Campbell, production contact engineer of United Aircraft Corp., Pratt & Whitney Div., has been appointed factory manager of the new plant for airplane engine production at Kansas City. Alexander Eigner, division superintendent in the Hartford plant has become machine shop superintendent, while Charles F. Toren has been made chief inspector at this plant, having been adavanced from position as assistant chief inspector at Hartford.

J. D. O'Brien has been made general manager of the Inland Manufacturing Div. of General Motors Corp., Dayton. The Brown-Lipe-Chapin Div. of the Guide Lamp Div. at Syracuse,

Brake Shoe Executive

W. M. BLACK

Aircraft Parts Head

BENJAMIN SACK

N. Y., has been made a separate division of General Motors with Norman M. Ross as general manager. C. W. Swayze who has been general manager of the Delco Radio Div. at Kokomo, Ind., has been named assistant to the general manager of the Eastern Aircraft Div. at Linden, N. J., and Berry W. Cooper, formerly comptroller of Delco-Remy Div., Anderson, Ind., and of the Delco Radio Div., has been advanced to general manager of the Delco Radio Div.

W. M. Black has been announced as vice-president of the American Brake Shoe and Foundry Co., Chicago. He will continue as president of the American Manganese Steel Div. of the company. Mr. Black joined this division in 1912 and became general sales manager in 1934 and vice-president in 1935.

W. R. Beatty, founder of the Beatty Machine and Mfg. Co., Hammond, Ind., has been named chairman of the board; L. C. Beatty has become president and P. H. Beatty, vice-president of the company.

Benjamin Sack, who has been executive vice-president of the Aircraft Screw Products Co., Inc., Long Island City, has been appointed president of the company. For over 25 years he has specialized in business management and has experience developed from active contact in many different industries.

Racy D. Bennett, well known in the machine tool industry as a hydraulic engineer and machine designer, has joined the engineering staff of the Vinco Corp., Detroit, as development engineer. L. A. Ward has also been added to the engineering staff. He has had wide experience in the application of hydraulics to machine tool design.

Charles A. Mabey, who has served for many years as physicist of the Bristol Co., Waterbury, Conn., has been appointed director of the research activities of the company.

George H. McBride has been made sales manager of the Nuttall Works of Westinghouse Electric & Mfg. Co.

Philip F. Smith, secretary of the Osborn Mfg. Co., Cleveland, has accepted an appointment as senior priority specialist in the Special Industrial Machinery Branch of the War Production Board.

J. M. Hopkins, associated for some time with Morris and Van Wormer, industrial engineers, New York City, has been made a partner.

David Bates has been announced as manager of the Specialties Div. of Abrasive Products, Inc., South Braintree, Mass. He was previously associated with Kelvinator, Bendix and General Electric.

Charles S. Comstock of Monsanto Chemical Co., Merrimac Div. at Everett, Mass., has been named production superintendent of that division.

William Park Woodside, president of American Twist Drill Co. for the past 18 years, has been made chairman of the board, while William F. Murray will succeed him as president. Mr. Woodside is a past president and founder member of the American Society for Metals.

W. F. Drysdale has been named president of Machinery Service Limited and executive assistant to Hon. C. D. Howe of the Department of Munitions and Supply, Ottawa.

T. Harrison has been appointed works manager, Canadian Pacific Railway, Car and Locomotive Dept. at the Ogden Shops, Calgary, Alberta.

Walter F. Cahill has recently been appointed agent for the Lincoln Park Tool and Gage Co., Lincoln Park, Mich., for the State of Michigan excepting Wayne County and Toledo.

PLANT EXPANSION

Onsrud Machine Works, Inc., Chicago, has enlarged its production floor space by the addition of a second floor and a new wing. This was accomplished without loss of time in any of the plant departments.

Vought-Sikorsky Div. of the United Aircraft Corp., Stratford, Conn., has taken over the plant of Mitchell Brothers, Bridgeport, and will move its entire engineering personnel to that building.

Airesearch Mfg. Co., a division of the Garrett Corp., will erect a new plant at Phoenix, Ariz., at the cost of about $500,000.

Savage Tool Co. formerly of Minneapolis has announced the removal of its plant and offices to Savage, Minn. The plant has a completely equipped metallurgical laboratory and scientifically designed gage department.

BUSINESS ITEMS

C. H. Briggs Machine Tool Co., Inc. has been organized in Syracuse, N. Y., to represent several manufacturers of machine tools. The new office is located in the Onondaga Hotel Bldg.

Norco Machinery Co., 2075 Mills Ave., Norwood, Ohio, has taken over the A. V. Carroll Sons Machinery Co. and will manufacture its line of pedestal and bench type milling machines.

Square D Co. has opened a branch office in Springfield, Mass., with C. T. Nash in charge.

The Pacific Tool and Supply Co., 344 N. Vermont Ave., Los Angeles, Calif., has changed its name to Brand Tool and Supply Co.

MEETINGS

National Safety Council. Annual meeting. Stevens Hotel, Chicago, Ill., Oct. 5-9.

National Metal Congress and Exposition. War Production Edition. Cleveland Public Auditorium. Oct. 12-16.

American Welding Society. Annual meeting. Hotel Cleveland, Cleveland, Ohio. Oct. 12-16.

American Society of Tool Engineers. Semi-annual meeting. Kimball Hotel, Springfield, Mass. Oct. 16-17.

Wire Association. Annual meeting. Detroit-Leland Hotel, Detroit, Mich. Oct. 19-23.

National Electrical Manufacturers Assn. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Oct. 26-30.

How to Do Business With Uncle Sam

THE ONLY CHANCE for most metal-working plants to stay in business today lies in getting war orders. The dimensions of the armament program have been finally set; planned regulation is replacing the chaotic conditions of early defense days. Here then is a summary of the steps to take now to get a contract, and—once having secured the contract—to get materials and capital to fill it

Chapter One ★ ★ ★ ★

FIRST STEPS

There's no simple formula for getting war work. Obviously, not everyone *can* get it. Newspaper stories about the fellow who is turning out war goods with a lathe in his cellar are heartening, and there have been a few such cases. But, in the main, unless you have a functioning plant, you'll just be breaking your heart and wasting your money if you look for a contract.

Finding war business is pretty much like finding any other kind of business. It's a matter of scratching for it by the ordinary techniques of selling—finding someone who wants a job done and convincing him you can do it.

Two preliminary steps: (1) Get together a presentable and complete survey of your manufacturing facilities, and (2) get an idea of what war goods you are capable of manufacturing. Keep an open mind on this latter point. You may end up with a contract for something unexpected, but you're a lot better off starting after a specific job than asking a busy procurement officer what he thinks you might do.

Your plant survey should include a description of your normal peacetime product and any war production you have done. Your business experience and a list of past and present customers should go in. You should list important managerial and technical personnel with a statement of their experience. Include a financial statement.

Show location, transportation, available power and water, and the like. Include complete layout plans and photographs of each section of the plant. List all machine tools and machinery as to type, make, size, age, serial number, and tolerances usually worked to.

Describe your labor situation also. Show the number of your factory employees and their skills. Estimate what your peak employment would be on one, two, and three

shifts. Analyze the available labor and local wage rates.

Then have someone put the survey into clear, readable form.

If you're vague as to what military requirements your plant might fit, you'll find useful samples of war goods on display at field offices of WPB's Bureau of Contract Distribution. Some of these exhibits are good, others pretty scrappy. Most Army procurement field offices maintain displays of the sort of goods they purchase.

At Contract Distribution field offices in the larger cities you'll find competent engineering staffs, men who can look over the description of your plant and advise as to what war goods you're best adapted to manufacture.

Two Sources of War Work

The two biggest sources of war work are prime contracts with federal war agencies and subcontracts obtained from firms holding prime contracts.

If your firm is a substantial, well-financed organization, if you have a technical and supervisory staff capable of following through on complete production of goods to rigid specifications, if you're not afraid of a certain amount of red tape and paperwork, you can well consider going after a prime contract.

Smaller, less well-equipped firms will do better to go after a subcontract. Don't forget that three-fourths of the contracts have gone to a hundred firms; there's an immense volume of subcontracts being placed. Working on a subcontract, you'll be doing business in ways you're more accustomed to. Moreover, you'll get the benefit of the technical savvy of big outfits which have been doing the work for some time.

Chapter Two ★ ★ ★ ★

GETTING PRIME CONTRACTS

If you decide to go after a prime contract, don't underestimate the job. You are a latecomer. By and large the armament program has jelled; the services have located most of their sources of supply, are not as hot after new contractors as they were a year ago. When you start looking for a contract these days you are bumping into those who got in on the ground floor.

This doesn't mean that there aren't contracts to be had. It does mean you will have to scurry around to find them, that you will have to work just as hard and persistently to get a government job as you ever did to get commercial business.

Government work has come more closely to resemble commercial business in another respect, too. The rigid formula of competitive bidding—hallmark of the public contract—has just about disappeared. At Donald Nelson's express order, negotiation has become the standard way of awarding contracts.

Negotiation can mean a variety of things. In some cases, particularly when buying specialized combat equipment, the procurement office calls in a few firms that look suitable, thrashes it out with them, and arrives at terms and price. Again, invitations may go out to a broad list of firms, asking them to submit informal quotations. These quotations then become the basis for discussion.

In the purchase of commercial and semicommercial items, nearly all the forms of competitive bidding are preserved. The information that quotations are wanted is broadcast, and bids are submitted in much the usual way. However, award to the lowest responsible bidder is not a matter of course. Many other factors enter, particularly speed of delivery. Awards may be made to several firms at different prices. There may be a certain amount of dickering over the quotation submitted.

Don't Aim Too High

Don't count heavily on getting any job that will require facilities beyond what you now have. There's no absolute rule on it, but the services now feel themselves in a position to pick and choose, want to hold additions to plant to a minimum. If you lack certain machines you'll be on much sounder ground if you line up someone who has the machines to go in with you on a subcontract basis. If you lack a good deal of the needed equipment, consider again the possibility of taking a subcontract for the part of the work that your present equipment can handle.

If you still want a prime contract, your first step is to determine which agency or agencies buy the goods you are prepared to make. If you are uncertain, consult your bank or the nearest local office of the Contract Distribution Bureau of WPB. Then get in touch with one of the field offices of that agency. There are a few exceptions, but most Army buying is now done through field offices, except on the largest contracts.

In the award of a war contract, price is secondary. But it's a factor. Basic approach is that a contractor is picked with little regard to the price at which he offers to do the job. Prime consideration is speed. To a lesser degree other elements enter—location, labor availability, conservation of transportation, and the like.

Once you have been chosen as the man to do the job, they'll start talking price—but tough! If your proposed price looks out of line, you'll be under pressure to accept a lower price. And after you go into production on a contract, your price will still be under scrutiny. If your actual costs prove lower than anticipated, the contract will be renegotiated.

Normally this will mean that deliveries made under the contract subsequent to renegotiation are at a lower price. If—accidentally or intentionally—you have collected excessive profits, you will be asked to make a refund. Strictly, you could stand on your contract, of course. But you won't. There are too many ways life can be made unpleasant for you.

The War Department recently stopped taking ac-

Where, What, and How the Army Buys

The Army's actual purchasing operations are specialized and decentralized among the various branches. Manufacturers capable of producing any item required by the military should communicate directly with the arsenal or depot responsible for the purchase of that item, as indicated on the list below.

ORDNANCE DEPARTMENT

The Ordnance Department arsenals and depots listed below are divided into two groups—A and B—for the purpose of classifying the commercial supplies purchased by each of them. Group A has been subdivided into A-1 and A-2 in order that the class of supplies these arsenals are interested in specifically, in addition to the general class of supplies, can be more easily identified.

GROUP A-1

Frankford Arsenal, Philadelphia, Pa.
Picatinny Arsenal, Dover, N. J.

GROUP A-2

Rock Island Arsenal, Rock Island, Ill.
Watertown Arsenal, Watertown, Mass.
Watervliet Arsenal, Watervliet, N. Y.
Springfield Armory, Springfield, Mass.

GROUP B

Aberdeen Proving Grounds, Md.
Augusta Ordnance Depot, Augusta, Ga.
Benicia Ordnance Depot, Benicia, Calif.
Charleston Ordnance Depot, N. Charleston, S. C.
Curtis Bay Ordnance Depot, Curtis Bay, Md.
Delaware Ordnance Depot, Pedricktown, N. J.
Erie Ordnance Depot, LaCarne, Ohio.
Hawaii Ordnance Depot, Ft. Shafter, Hawaii
Nansemond Ordnance Depot, Portsmouth, Va.
Ogden Ordnance Depot, Ogden, Utah
Raritan Ordnance Depot, Metuchen, N. J.
San Antonio Ordnance Depot, San Antonio, Tex.
Savanna Ordnance Depot, Savanna, Ill.
Wingate Ordnance Depot, Fort Wingate, N. M.

Supplies and services usually procured by Groups A-1, A-2, and B:

General maintenance supplies; packing and shipping materials—lumber, box shooks, strapping, etc.; electrical supplies—light and power; general construction supplies; automotive equipment and maintenance supplies; paints and oils for ordnance material.

Supplies and services usually procured by Group A-1:

Machines and machine tools—lathes, shapers, grinders, etc.; iron and steel—wire, bars, rods, plates, shapes, forgings, castings; copper brass, and bronze—wire, bars, rods, plates, strips, castings, forgings; aluminum and aluminum alloys, bars, plates, rods, shapes, sheets, strips, castings; chemical and physical laboratory supplies; industrial chemicals; weighing scales—sensitive balances—and larger; explosives processing equipment; explosives and separate explosive ingredients; cartridge brass; electro-plating equipment and supplies; heat-treating furnaces and accessories; gages, dies, etc.; wood-working machinery and supplies; optical instruments and accessories; manufactured metal components; welding equipment and supplies.

Supplies and services usually procured by Group A-2:

Machines and machine tools—lathes, shapers, grinders, etc.; iron and steel—wire, bars, rods, plates, shapes, forgings, castings; copper, brass and bronze—wire, bars, rods, plates, strips, castings, forgings; aluminum and aluminum alloys—bars, plates, rods, shapes, sheets, strips, castings; chemical and physical laboratory supplies; electro-plating equipment and supplies; spray-painting equipment and supplies; dies, molds, gages, etc.; heat-treating furnaces and accessories; wood-working machinery and supplies; manufactured metal components; welding equipment and supplies.

AIR CORPS

Contract Section, Air Corps, Wright Field, Dayton, Ohio

Airplanes, airplane parts, equipment, accessories; flying equipment and supplies; lighting and photographic equipment; parachutes; special and technical instruments and equipment; aviation fuel.

CHEMICAL WARFARE SERVICE

Edgewood Arsenal, Edgewood, Md.
Boston C. W. Procurement District, 2000 U. S. Post Office Bldg., Boston, Mass.
New York C. W. Procurement District, 292 Madison Ave., New York City
Pittsburgh C. W. Procurement District, American Bank Building, 6th Ave. and Grant St., Pittsburgh, Pa.
Chicago C. W. Procurement District, 1506 N. Wacker Dr., Chicago, Ill.
San Francisco C. W. Procurement District, Room 201, 1355 Market St., San Francisco, Calif.

Chemicals; ceramics; chemical plant equipment; specially prepared fabrics; duck, felt, cloth, webbing; gas masks and components of fabric, glass, metal, moulded rubber, and plastics; machines and machine tools; activated charcoal.

SIGNAL CORPS

Officer in Charge, Philadelphia Signal Corps Procurement District, Wissahicken Ave. and Abbotsford Rd., Philadelphia, Pa.

Radio communication equipment; telephone and telegraph equipment; wire and cable; meteorological equipment; signal corps photographic equipment; coding and cipher devices; pigeon equipment.

Officer in Charge, Chicago Signal Corps Procurement District, 1819 West Pershing Road, Chicago, Illinois

Telephone and telegraph equipment; coding and cipher devices; wire and cable; radio communication equipment.

Officer in Charge, San Francisco Signal Corps Procurement District, Presidio of San Francisco, California

Small quantities of miscellaneous equipment covering telephone and telegraph; wire and cable; radio communication equipment, and certain pigeon equipment and accessories.

Director, Aircraft Radio Laboratory, Wright Field, Dayton, Ohio

Special experimental research and development equipment for aircraft communications, and navigational purposes.

Director, Signal Corps Laboratories, Fort Monmouth, Red Bank, New Jersey

Special communication equipment for motorized and armored forces; parachute, and other special designs of communication equipment; fire control and ground radio communication equipment; experimental research and development equipment for communication purposes.

Officer in Charge, Signal Corps Photographic Laboratory, Army War College, Washington, D. C.

Photographic equipment.

Signal Corps supplies and equipment of a nature similar to that listed above are purchased to a limited extent by the following agencies:

Address mail to:
The Chief Signal Officer
Munitions Building, Washington, D. C.

Address mail to: The Signal Officer
First Corps Area, Army Base, Boston, Mass.
Second Corps Area, Governor's Island, New York
Third Corps Area, U. S. Post Office Bldg. and Court House, Baltimore, Md.
Fourth Corps Area, Post Office Bldg., Atlanta, Georgia
Fifth Corps Area, Fort Haynes, Columbus, Ohio
Sixth Corps Area, U. S. Post Office Bldg., Chicago, Ill.
Seventh Corps Area, Federal Bldg., 15th and Dodge Street, Omaha, Neb.
Eighth Corps Area, Fort Sam Houston, San Antonio, Texas
Ninth Corps Area, Presidio of San Francisco, California

Address mail to: The Department Signal Officer
Hawaiian Department, Fort Shafter, Hawaii
Panama Canal Department, Quarry Heights, Canal Zone
Puerto Rican Department, San Juan, Puerto Rico

Address mail to: The Commanding Officer
Hawaiian Signal Depot, Signal Corps Area, Fort Shafter, T. H.

Address mail to: The Officer in Charge
Alaskan Communication System, 517 Federal Office Building, Seattle, Washington
War Department Message Center, Washington, D. C.

Address mail to: The Signal Corps Liaison Officer
Research Council, Academy of Motion Picture Arts and Sciences, Hollywood, Calif.

CORPS OF ENGINEERS (Military)

Contracting Officer, Office of the Chief of Engineers, Room 2215, War Department, Washington, D. C.

Corrugated steel arches; cotton and canvas bags; drafting, photographic, lithographic, photo-engraving, and surveying equipment; steel bridges, buildings, dredges, power shovels, storage tanks, sawmills; heavy machinery, boilers, cranes, hoists, jacks, hydraulic presses, transformers, gasoline and electric engines; locomotives, railroad cars, and air-brake equipment; hand tools; dump wagons; camouflage equipment, air compressors and tools.

Engineer supplies and equipment of a nature similar to that listed above are purchased to a limited extent by the following agencies:

Address mail to: The Engineer
First Corps Area, Army Base, Boston 9, Mass.
Second Corps Area, Governors Island, N. Y.
Third Corps Area, U. S. Post office and Court House, Baltimore, Md.
Fourth Corps Area, Old Post Office Bldg., Atlanta, Georgia
Fifth Corps Area, Fort Hayes, Columbus, Ohio
Sixth Corps Area, 1300 New Post Office Bldg., Chicago, Ill.
Seventh Corps Area, Federal Bldg., 15th and Dodge Streets, Omaha, Neb.
Eighth Corps Area, Ft. Sam Houston, Texas
Ninth Corps Area, Presidio of San Francisco, Calif.

Address mail to: The Officer in Charge
The Engineer Reproduction Plant, The Army War College, Washington, D. C.

Address mail to: Engineer Supply Officer, Engineer Section
Columbus General Depot, Columbus, Ohio
San Antonio General Depot, Ft. Sam Houston, Texas
New York General Depot, 58th St. and 1st Ave., Brooklyn, N. Y.
San Francisco General Depot, Ft. Mason, San Francisco, Calif.
Schenectady General Depot, Schenectady, N. Y.

Address mail to: The Engineer Board, Fort Belvoir, Va.

COAST ARTILLERY CORPS

Submarine Depot, Fort Monroe, Va.

Submarine mine equipment and supplies.

Coast Artillery School, Fort Monroe, Va.

Scientific laboratory equipment.

count of cash discounts in comparing prices because too often the discounts don't get taken. However, if payment is made promptly, the usual discounts will be expected.

Subject to Price Ceilings

Sales to Army, Navy, or other war agencies are subject to the terms of price ceilings established by the Office of Price Administration just as are any other sales. However, exemptions for certain kinds of war business have been written into a good many OPA regulations.

If you are not covered by a specific regulation, one of two broad regulations is likely to apply. The General Maximum Price Regulation, by and large, freezes the price of all commodities and services not otherwise covered at the levels of March, 1942. Regulation 136 freezes machinery prices at October, 1941, levels. Both orders exempt sales of ships, combatant equipment, and explosives or parts of these things. Also exempt are experimental, developmental, secret, and emergency maintenance contracts. Exempt goods are generally covered by special orders aimed at government work.

Furthermore, OPA and the services are agreed that no price considerations should be allowed to stand in the way of production. Whenever a special situation arises where such interference appears to exist, an application can be submitted to OPA for a change in the price regulation. As soon as the application is submitted, the service and the contractor proceed on the assumption that OPA has acquiesced. If the application is subsequently denied, prices are adjusted and refunds made if necessary.

When, as at present, contracts are mostly negotiated, a policy of renegotiation is almost inevitable. A price is set when a contract is negotiated; it may easily turn out that the price is far out of line, especially if economies of mass production begin to show up. It is only after production is well started that a price yielding a reasonable profit can be determined.

No Rigid Profit Standard

By mandate, first of the WPB and subsequently of Congress, the Army, Navy, and Martime Commission now insert in all contracts of more than $100,000 a clause providing for changing the price if the profit appears to be excessive. The restudy is to be made as soon as production has gone far enough to give a fair indication of costs.

No rigid standards have ever been established as to what is an excessive profit—not even as to whether the profit in question should be figured on gross business or on investment. It's simply a matter of the personal judgment, in the first instance, of the procurement officer, and in the final decision, of Price Adjustment Boards set up in Army, Navy, and Maritime, aided by the Cost Analysis Section of WPB.

Objective is to avoid profits which will be far out of line with either capital or gross business. Considerable weight is given to the profit levels prevailing in similar firms; some attention is even paid to such moralistic factors as whether the firm in question got into war production early and willingly.

On the related question of distinguishing between cost items and profit items, the services are guided by a comprehensive regulation drawn up by the Treasury two years ago. Incorporated in a document, TD-5,000, this regulation deals with such questions as what selling expenses may be charged as costs. Familiarize yourself with it. An explanation of TD-5,000, as interpreted by Army and Navy auditors, is available from the Superintendent of Documents in Washington under the title, "Explanation of Principles for Determination of Costs under Government Contracts." It costs 10 cents.

If you are used to doing heavy work in metal, chances are that your best bet is Army Ordnance or the Navy Bureau of Ordnance. These are the agencies which buy fighting equipment—guns, ammunition, armor, combat vehicles.

Army Buying Decentralized

Army ordnance buying is decentralized through its field offices, which are partially specialized as to the things they buy. On large and specialized contracts, contractors are picked in Washington, but on the run-of-the-mill stuff negotiating is done in the field. There is little widespread invitation to bid; a few contractors are called in for negotiation. You should get in touch with the nearest ordnance field office dealing in the goods you want to make and ask that your plant be surveyed.

Naval ordnance buying is all handled out of Washington. If you want to be considered, send data on your plant to the Chief of the Bureau of Ordnance, Navy Department, Washington.

Aircraft and flying equipment is bought by Army Air Corps at the Wright Field Contract Section, Dayton, Ohio, and by the Navy Bureau of Aeronautics in Washington.

The contracting officer of the Office of the Chief of Engineers in Washington buys a substantial quantity of construction equipment, mostly of a normal commercial type.

All Army communication equipment is bought by the Signal Corps through its field offices.

The Chemical Warfare Service buys equipment for waging gas and incendiary war and equipment for protection of soldiers and civilians against gas attacks. Large contracts are cleared in Washington, but all negotiations are carried on through the district offices. Usual way of awarding contracts is to call in a few firms whose plants have been surveyed and negotiate with them. Contracts are almost always on a fixed price basis.

If you want a chance at Chemical Warfare business, get in touch with the nearest district office. There you can look over samples of the sort of thing CWS buys. If you think you could make some of them, ask for a survey of your plant. CWS officers will look over your ma-

chines, layout, labor force, and the like. If they like your set-up, you'll be on the list for consideration.

To get a preliminary idea of CWS activities, send to Book Dept., Chemical Warfare School, Edgewood Arsenal, Md., for the pamphlet—"Chemical Warfare and the Chemical Warfare Service."

The Maritime Commission is a substantial buyer, particularly in connection with the Liberty ship program of emergency freighters. Contracts placed with shipyards for these ships cover only assembly of materials, parts, and equipment furnished by the commission. Thus the commission has occasion to buy directly all the goods that enter into building and equipping a ship.

All this purchasing is done through the Washington office of the commission. Fixed price contracts are placed by negotiation. Negotiations, in turn, are based on informal quotations solicited from 15 or 20 potential suppliers. To make yourself eligible for an invitation to quote, you should visit or write to the offices of the commission and present the data on your plant.

The last big war buyer is the Procurement Division of the Treasury. This agency, in peacetime, is the federal government's central buying agency. To it has been assigned the purchase of lend-lease goods other than those of a strictly military nature—stuff ranging from drugs and chemicals to road-building machinery. Although Procurement has state field offices, its war buying is done through Washington.

Informal proposals are submitted to all eligible suppliers, usually by telephone or telegraph. Awards are usually made to the low bidder up to his production capacity and then to other bidders if they are willing to meet the figure of the low bidder.

If you want a chance to submit quotations, write to the Director of Procurement, Procurement Division, 7th and D St., S.W., Washington. State that you would like to participate in war business, explain your financial standing and the goods in which you normally deal, and ask for a mailing list questionnaire. After filling out the questionnaire, you will be placed on the list.

Chapter Three ★ ★ ★ ★

HANDLING SUBCONTRACTS

There's no mystery about subcontracting. It's mostly a matter of getting business from the same sort of people you are used to doing business with in peacetime. And in just about the same way.

Find out whether firms with whom you ordinarily do business have war contracts. If so, try to get subcontracts from them before you start working the field.

It's possible to get lists of prime contractors and start canvassing them wholesale. Some people, if they're energetic and have a good story to tell, get contracts that way. But it's the hard way to get war business today.

To save your time and that of prime contractors, the War Production Board has established the Bureau of Contract Distribution with hundreds of field offices around the country. This bureau is essentially a contract brokerage outfit. Each field office is supposed to keep in touch with the prime contractors in its area and with their requirements for subcontractors. It is the point of contact for would-be subcontractors, and it is expected to bring the primes and the subs together.

Visit the Contract Distribution Office

Your cue, therefore, is to visit the Contract Distribution office nearest you. These offices vary greatly in skill and usefulness. You'll have to form your own conclusions as to what kind you are dealing with. If, after giving your local office a fair trial, you conclude you are getting nowhere, get a list of local prime contractors from this office and start cruising around.

Very likely you'll encounter an active and energetic field office. It probably will have an engineering staff to go over your plant-survey data with you and help you decide what different kinds of things you are equipped to make. It's possible they'll recommend that you seek a prime contract for some particular item. If so, they'll tell you where to go and whom to see.

Alternatively, they may decide your case is hopeless. Nowadays, the field offices are inclined to tell you the truth if they think you just aren't equipped for war work. They'll recommend that you shut down or find some civilian business that doesn't compete with war needs.

Of course, you don't have to accept this verdict as final. Clever production men have taken, say, stamping machinery (for which there's not so much war demand) and rerigged it to do a needed war job. But you'd better at least consider the advantages of taking "no" for an answer.

In your case, however, let's assume there are several types of jobs you might do. The good Contract Distribution offices will have files of prime contractors who are looking for concerns to do one of these jobs. They'll send you to one or more of these firms with a letter of introduction. Then it's up to you to convince the prime contractor you can do the job; he'll need some convincing, because he has to answer for the quality of the work you turn out.

Weakest point in this procedure is the method of finding out what your plant can do. It's hard to staff the field offices with engineers who have a sufficiently broad knowledge of all sorts of industrial operations.

Several schemes are now being tried which overcome this difficulty by having the prime contractor himself analyze the jobs he'd like to subcontract and determine what equipment is needed. The best known of these is the "Stanley Plan" being used in Chicago. A simplified variant is being tried in New England. If these schemes work out as well as the first experiments suggest, something like them may soon be used everywhere.

Basis of all these schemes is a system of code letters or numbers to designate particular types of machines. Prime contractors determine what machines are needed to do a job they have in mind. Then, instead of referring the job to Contract Distribution in terms of a finished product, they describe it in a set of code numbers indicating the equipment needed. In Chicago, lists of these coded jobs are published weekly; a would-be contractor needs only to look over the list and find what jobs call for his equipment.

Where to Go for Assistance on Priorities

Initial point of contact of a manufacturer seeking war contracts or subcontracts should be the field offices of the War Production Board's Bureau of Contract Distribution. A second frequently used service is the local offices of the Priorities Bureau. Field offices of both types report to regional WPB offices at Atlanta, Boston, Chicago, Cleveland, Dallas, Denver, Detroit, Kansas City, Minneapolis, New York, Philadelphia, San Francisco, and Seattle.

In the list below, names with a "C" before them refer to men concerned with contract distribution, and those with a "P," priorities.

State and City	*Name*	*Address*
Alabama		
Birmingham	P—Martin J. Lide	302–306 Phoenix Bldg.
Birmingham	C—L. E. Geohegan	301 Phoenix Bldg.
Arizona		
Phoenix	P—Lee G. Browne	408 Security Bldg.
Phoenix	C—William I. Walsh	406 Security Bldg.
Arkansas		
Fort Smith	C—Frank P. DeLarzelere	13 North 7th St.
Little Rock	P—Charles S. Christian	Rector Bldg.
Little Rock	C—Alfred M. Lund	304 Rector Bldg.
California		
San Francisco	P—James A. Folger	1355 Market St.
San Francisco	C—Col. Francis M. Smith	1355 Market St.
Fresno	C—H. A. Mattern	314–318 Mattei Bldg.
Los Angeles	P—A. R. Thomas	1040 Western Pacific Bldg.
Los Angeles	C—Watt L. Moreland	1031 South Broadway
Oakland	C—W. P. Collins	209 Financial Center Bldg.
San Diego	C—Paul C. Farmer	510 Union Bldg.
Sacramento	C—Orlando McCraney	Farmers & Mechanics Bldg.
Colorado		
Denver	P—Virgil L. Board	521 U. S. National Bank Bldg.
Denver	C—El Roy Nelson	U. S. National Bank Bldg.
Pueblo	C—D. F. Stalker	Star Journal Bldg.
Connecticut		
Hartford	P—Edwin L. Howard	119 Ann St.
Hartford	C—Earle L. Milliken	Phoenix Bank Bldg.
Bridgeport	C—Raymond L. French	144 Golden Hill St.
New Haven	C—Chas. A. Newton	514 Liberty Bldg.
Delaware		
Wilmington	C—Bradley L. Geist	314 Penn Bldg.
Florida		
Jacksonville	P—George H. Andrews	530 Lynch Bldg.
Jacksonville	C—Chas. C. McCubbin	730 Lynch Bldg.
Miami	C—Forrest D. Banning	701 Congress Bldg.
Tampa	P—Herbert Brennan	901 Wallace South Bldg.
Tampa	C—Arthur B. Hale	901 Wallace South Bldg.
Georgia		
Atlanta	P—John B. Reeves	116 Candler Bldg.
Atlanta	C—J. V. Booth	116 Candler Bldg.
Idaho		
Boise	C—L. O. Johnson	409 Capital Securities Bldg.
Illinois		
Chicago	P—Edmund H. Eitel	20 North Wacker Drive
Chicago	C—Thomas N. Wynne	20 North Wacker Drive
Decatur	C—G. E. Hale	308 Standard Office Bldg.
Peoria	C—Ralph W. Pritchard	2d Floor, Alliance Bldg.
Springfield	C—Edward Gerrity	407 Leland Office Bldg.
Indiana		
Evansville	C—Vincent Terry	8 Koenig Bldg.
Fort Wayne	C—George A. Dinnen	410 Utility Bldg.
Indianapolis	P—Albert O. Evans	Circle Tower Bldg.
Indianapolis	C—Harry S. Rogers	Circle Tower Bldg.
South Bend	C—Howard E. Richardson	206 City National Bank Bldg.
Iowa		
Des Moines	C—Geo. Beese	708 Crocker Bldg.
Kansas		
Wichita	C—Harold Hartzell	1314 Union National Bank Bldg.
Kentucky		
Louisville	P—James T. Hosington	400 Todd Bldg.
Louisville	C—Prentiss M. Terry	200 Todd Bldg.
Louisiana		
New Orleans	P—Louis House Clay	423 Canal Bldg.
New Orleans	C—R. E. Judd	423 Canal Bldg.
Shreveport	C—John B. Ferchaud	916 Giddens Lane Bldg.
Maine		
Bangor	C—Charles E. Walker	44 Central St.
Portland	C —Herbert Payson, Jr.	142 High St.
Maryland		
Baltimore	P—T. M. Chandlee	1054 Baltimore Trust Co.
Baltimore	C—G. W. Creighton	1254 Baltimore Trust Co.
Massachusetts		
Boston	P—W. P. Homans	17 Court St.
Boston	C—Edward V. Hickey	17 Court St.
Fall River	C—Harold S. Ramsay	27 South Main St.
Lowell	C—W. E. Stanwood	Sun Bldg., 8 Merrimac St.
Springfield	C—H. G. Philbrook	95 State St.
Worcester	C—Dwight C. Daniels	State Mutual Bldg.
Michigan		
Detroit	P—James E. Wilson	7310 Woodward Ave.
Detroit	C—Stoner Yantis	7310 Woodward Ave.
Grand Rapids	C—Herman Pleasant	1004 Michigan National Bank Bldg.
Iron Mountain	C—George Wallner	400 Commercial National Bank Bldg.
Minnesota		
Duluth	C—Arthur J. Newman	416 Federal Bldg.
Minneapolis	P—Willard F. Kiesner	326 Midland Bank Bldg.
Minneapolis	C—Earl Pitney	326 Midland Bank Bldg.
Mississippi		
Jackson	C—A. G. McIntosh	605 Tower Bldg.
Missouri		
Kansas City	P—Charles B. Shaeffer	Mutual-Interstate Bldg.
Kansas City	C—R. W. Webb	508 Mutual Bldg.
St. Louis	P—Ward H. Goodloe	943 Paul Brown Bldg.
St. Louis	C—F. J. McDevitt	1131 Paul Brown Bldg.
Montana		
Helena	P—Oscar A. Baarson	Room 512, Power Block House
Helena	C—Howard Bogie	222 Power Block Annex

The 13 regional offices of the War Production Board publish regional news letters—"War Production News." These carry lists of prime contract and subcontract opportunities, machines available for sale, machines wanted, and the like. You should arrange with your local field office to get on the list to receive its news letter.

The new Smaller War Plants Law gives certain additional powers to the War Production Board which will mostly be exercised through the machinery of the Contract Distribution Bureau, though perhaps under a dif-

and Subcontracts

State and City	Name	Address
Nebraska		
Omaha	P—Victor H. Black	512 Grain Exchange Bldg.
Omaha	C—W. Ralph Morgan	501 Grain Exchange Bldg.
Nevada		
Reno	C—Edwin S. Bender	Saviers Bldg.
New Hampshire		
Manchester	C—Daniel S. Hickey	Amoskeag Industries Bldg
New Jersey		
Newark	C—R. L. Kennedy	Globe Bldg.
Camden	C—Frederick Cohen	Broadway Stevens Bldg.
Trenton	C—R. Emmett Carroll	City Center Bldg.
New Mexico		
Albuquerque	C—George Lusk	103½ West Central Ave.
New York		
Albany	C—F. J. Holman	112 State St.
Brooklyn	C—Emile Z. Weinberg	16 Court St.
Buffalo	P—Paul R. Smith	312 M. & T. Bank Bldg.
Buffalo	C—Thos. J. O'Rourke	212 M. & T. Bank Bldg.
New York City	P—Sydney Hogerton	Chanin Bldg.
New York City	C—W. O. Crabtree	Chanin Bldg.
Rochester	C—Mahlon Gregg	Commerce Bldg.
Syracuse	C—T. D. Harter	302 Starrett Syracuse Bldg.
Utica	C—Earle R. Mason	First National Bank Bldg.
North Carolina		
Charlotte	P—J. E. MacDougall	Liberty Life Bldg.
Charlotte	C—Eugene C. Ochsenreiter	New Liberty Life Bldg.
Raleigh	C—Irving F. Hall	Sir Walter Hotel Bldg., P. O. Box 2658
North Dakota		
Bismarck	C—Paul W. Fawcet	14 First National Bank Bldg.
Ohio		
Canton	C—E. Oscar Kuendig	601 Commercial Bldg.
Cincinnati	P—Elmer C. Henlein	34 East 4th St.
Cincinnati	C—Thomas Grace	804 Union Trust Bldg.
Cleveland	C—Henry F. Jordan	Union Commerce Bldg.
Columbus	C—B. C. Zuhars	513 East Town St.
Dayton	P—Harold B. Doty	819 3d National Bank Bldg.
Dayton	C—Collins Wight	819 3d National Bank Bldg.
Toledo	C—Alvin E. Buchenberg	833 Security Bank Bldg.
Youngstown	C—Leif Oyen	1002 Union National Bank Bldg.
Oklahoma		
Oklahoma City	P—C. F. Aurand	414–416 Key Bldg.
Oklahoma City	C—Morton R. Harrison	540 Key Bldg.
Tulsa	C—John H. Keys	435 Kennedy Bldg.
Tulsa	P—Alfred E. Ballin	416 Kennedy Bldg.
Oregon		
Portland	P—John Fred Bergesch	806 Bedell Bldg.
Portland	C—John G. Barnett	815 Bedell Bldg.
Pennsylvania		
Allentown	C—Ernest R. Fallin, Jr.	506 Hamilton St.
Chester	C—Abbott Smith	12–14 East 5th St.
Erie	C—Harry B. Joyce	715 Erie Trust Co. Bldg.
Harrisburg	C—Ritchie Lawrie, Jr.	Doehne Bldg., 24 South 4th St.
Johnstown	C—John S. Wagoner	U. S. National Bank Bldg.
Lancaster	C—Arthur K. Barnes	655 Woolworth Bldg.
Norristown	C—Felix P. Cross	Norristown Penn Trust Co.
Philadelphia	P—George McGovern	Broad Street Station Bldg.
Philadelphia	C—Orville H. Bullitt	Broad Street Station Bldg.
Pittsburgh	P—Charles F. Cruciger	403 Fulton Bldg.
Pittsburgh	C—Charles E. Robinson	405 Fulton Bldg.
Reading	C—John A. Archer	615 Penn St.
Scranton	C—J. P. Eyre Price	415 First National Bank Bldg.
Wilkes-Barre	C—W. H. Pierce	53 West Market St.
Williamsport	C—Fred J. Livingston	Susquehanna Trust Co. Bldg.
York	C—Richard S. Cole	25 North Duke St.
Rhode Island		
Providence	C—Arthur J. Minor	530 Industrial Trust Bldg.
South Carolina		
Columbia	C—D. E. McDuffie	204–206 Manson Bldg.
South Dakota		
Sioux Falls	C—Fred M. Chase	309–310 Boyce Greely Bldg.
Tennessee		
Chattanooga	C—Paul E. Shacklett	909–910 James Bldg.
Knoxville	P—D. K. Porteous	2d floor Goode Bldg.
Knoxville	C—W. W. Mynatt	204–205 Goode Bldg.
Memphis	P—John K. Lester	2110 Sterick Bldg.
Memphis	C—Arthur M. Field	2112 Sterick Bldg.
Nashville	P—George S. Gillen	1014 Stahlman Bldg.
Nashville	C—W. G. Whitsitt	1014 Stahlman Bldg.
Texas		
Dallas	P—John B. Joyce	11th floor, Fidelity Bldg.
Dallas	C—A. J. Langford	4th floor, Fidelity Bldg.
El Paso	P—Robert Stryker	223 El Paso National Bank Bldg.
El Paso	C—L. A. Wilke	222 El Paso National Bank Bldg.
Houston	P—George L. Noble, Jr.	1020 Electric Bldg.
Houston	C—I. M. Griffin	9th floor, Electric Bldg.
San Antonio	P—Carl Pool	801 Majestic Bldg.
San Antonio	C—P. E. Locke	816 Majestic Bldg.
Utah		
Salt Lake City	P—Ralph E. Bristol	248 South Main St.
Salt Lake City	C—Bayard W. Mendenhall	306 David Keith Bldg.
Vermont		
Montpelier	C—A. M. Creighton, Jr.	12 State St.
Virginia		
Norfolk	C—J. L. Mason	526 Dickson Bldg.
Richmond	P—F. P. Wilmer	10 South 5th St.
Roanoke	C—J. L. Mason	118 Kirk Ave. SW.
Washington		
Seattle	P—William D. Shannon	White-Henry-Stuart Bldg.
Seattle	C—Harry J. Martin	White-Henry-Stuart Bldg.
Spokane	C—Lars Carlson	Old National Bank Bldg.
West Virginia		
Charleston	C—E. J. McClees	24 Capital City Bldg.
Clarksburg	C—Alex H. Cooper	759–761 Empire National Bank Bldg.
Huntington	C—Frank Enslow	309–311 West Virginia Bldg.
Wheeling	C—E. C. Drake	Fidelity Bldg.
Wisconsin		
Appleton	C—Paul W. Romig	341 W. College Ave.
Eau Claire	C—Dorance W. Walters	128½ Graham Ave.
Madison	C—John D. Howard	405 Washington Bldg.
Milwaukee	P—Frank J. Tharinger	7048 Plankinton Bldg.
Wausau	C—Ray Miller	408 3d St.
Wyoming		
Casper	C—R. G. Corbett	Box 1211

ferent name. Under this law, WPB can direct the armed services to award a specific contract to a particular firm.

This is a power which will doubtless be used sparingly, but its existence gives additional weight to the conclusions of your Contract Distribution field office if it decides you should have a prime contract. The law also empowers WPB to make loans or provide plant facilities to smaller firms which don't fit into any of the present arrangements for war credit.

Still of uncertain significance is another section of the law which, in effect, creates a new category of contract midway between the prime contract and the subcontract. The Smaller War Plants Corp., a new WPB subsidiary, is empowered to take contracts from the Army and Navy and then sublet them to small firms. It's doubtful whether any widespread use will be made of this power, but if any such contracts are to be placed, you can keep in touch through the field offices of Contract Distribution.

As a subcontractor, you are entitled to most of the financial aids and tax concessions available to prime contractors.

Chapter Four ★ ★ ★ ★

HOW TO GET MATERIALS

Priorities began as a system of putting war work ahead of civilian work. Now it has become a means for regulating the input of raw materials, the output of end products, and the flow of goods through the whole economy, war and civilian.

Things were pretty bad while the change was being made, but they're straightening out now.

Regulation of material flow falls into three broad groups. First and biggest is the scheduling of materials to be fabricated—guiding the flow from the raw material producer to the manufacturer of finished goods. This is done through the broad framework of the Production Requirements Plan.

Second is the handling of capital goods, the decision as to who builds a new plant, who gets a new machine, where a new road shall go. These decisions are being centered in the War Production Board, are carried out through the issuance of PD-1A (individual) and P-19 (project) priorities granting approval to specific jobs.

Finally, there is the problem of the nonfabricating industries—public utilities, railroads, mines, and the like. Their primary need for goods is maintenance and repair and operating supplies. These industries will be handled through a new Maintenance Requirement Plan.

Basic element in the Production Requirements Plan is that, at the beginning of each quarter-year, WPB has before it an estimate of the material requirements of every fabricator in the country who uses more than $5,000 worth of metal each quarter. Inasmuch as the estimated production of raw materials is known, WPB proceeds to scale down the requirements of each fabricator to the point where total requirements will match total raw materials available.

Reduction Based on Importance

The reduction is made in accordance with the war importance of the fabricator's product. Manufacturers of essential weapons wouldn't have their requirements cut down at all. Some manufacturers of consumers' goods (particularly durable) might be eliminated altogether.

Then WPB grants a priority rating or several ratings on the scaled-down requirements of each fabricator. In theory, it doesn't matter much what the rating is. If the job has been done properly, if all requirements have been scaled down until the total matches the total of available materials, then anyone who has a rating will get his allotment.

However, even bureaucrats are human, and the rating serves as a safety valve. It establishes that, if a mistake has been made and ratings have been issued on too much stuff, the man with the low rating gets left. As time passes and the system is perfected, this should happen less and less often.

In theory again, this system should provide a complete control. Ratings assigned to fabricators on definite quantities of goods would be passed along, up the stream of commerce, to arrive finally at the raw material producer. The orders he received would just match his production because it was planned that way. Obviously, it won't work out so neatly.

Another safety valve is provided—allocation of raw materials. The raw material producers submit their order books to WPB, which tells them which of the orders to fill. In order to do this intelligently, WPB has to know the final destination of the steel or zinc or rubber being ordered from the prime producer by intermediate fabricators and processors.

Code Shows Ultimate Use

The Allocation Classification System provides the way of doing this. Manufacturers of end products are required to attach to orders they place for materials and parts a code number identifying the use to which these supplies will be put. Code numbers run from 1.00 to 23.90. A code designation of 10.20, for instance, would indicate that the end product in question had to do with highway transportation.

Under ACS, when an intermediate fabricator buys material to fill the order from the end-product manufacturer, he passes on the code number designation. If the material he is ordering will be used to fill orders from several end-product manufacturers, he attaches several code numbers to the order, showing the percentage of the order to which each code number applies.

Thus, when orders finally get to the raw material producers, they carry code numbers identifying the general purpose of products into which the materials will flow if the order is filled—and showing what will suffer if WPB decides not to have the order filled.

Your business has two points of contact with this system. Every day you have to attach ACS code numbers to orders you place; four times a year you must fill out the Production Requirements Plan application form—PD-25-a. This document, four over-size sheets of fine print, calls for a remarkably searching analysis of the current status of your business and your material needs for the coming quarter.

You report deliveries of each of your products for the last quarter and estimated production for the coming quarter, together with an analysis of the priority ratings and end uses of the deliveries you made in the last quarter and those you propose to make for the coming quarter. Then, for each material, part, or subassembly you purchase, you report your last-quarter consumption, inventory position, probable next-quarter consumption, and anticipated purchases. You must also show which of your products each material goes into. Next to the item of anticipated purchases you leave a blank space.

You send the form to the War Production Board, and after a while it comes back with quantities written into the blank space showing how much of each material you may purchase and giving you a priority rating on purchases up to that amount during the coming quarter. If your situation changes during the quarter so that you need more of some material, you may file a supplementary application—PD-25-f.

The Production Requirements Plan is designed to meet the needs of fabricating industries—plants which receive raw material, cut it up, and sell it to someone else. Such plants get their maintenance and repair goods more or less as an incident to PRP. But there's a considerable group of industries which don't chew up material but have substantial maintenance requirements—utilities, transportation, mines, and the like.

For the present, such firms are still operating under P-100—the general order granting an A-10 rating to all maintenance and repair needs—or under one of several orders granting high priority ratings to the maintenance needs of specific industries. Starting probably in the fourth quarter, they will be covered by a new Maintenance Requirements Plan, similar to but simpler than PRP.

To operate under MRP, a firm will submit a quarterly report, setting forth its maintenance requirements in the past quarter and an estimate of its maintenance needs, showing the amount of each material, in the coming quarter, together with a few figures on the total business it does. WPB will then decide how much of the requirements can be met, indicate these on the application, and return it with a priority rating or ratings.

Initial intention is to be rather liberal in approving maintenance needs. Probably approval will be given in full to any request the dollar value of which does not exceed 10 percent of gross business, where the percentage of gross business is less than or equal to the percentage of the industry as a whole.

Several priority ratings will be granted—a high rating such as A-1-a on a percentage of the requirements, A-1-c on another portion, A-2 on another, and perhaps A-8 or A-10 on the rest. These ratings would not be tied to particular goods needed, so that the firm could use the high rating on the hard-to-get stuff, the low ones on the easier material.

This scheme is still in its initial stages and may be considerably modified before it goes into effect.

Some Priorities Survive

PRP and MRP, between them, will soon be governing most of the flow of raw material through industry. But priorities control has had a long history; a considerable number of devices have been tried at various times and some of them still survive. You should be able to recognize them.

Most important are PD ratings, P orders, M orders, and L orders.

The aboriginal form of priority document is the so-called PD rating. There are now two of them, PD-1A and PD-3A. Each of them attaches a priority rating to a specific order for goods. That is to say, it directs the supplier receiving the order to give it preference over other orders with a lower rating or none at all. And it permits the supplier to demand the same preference when he orders the materials he needs to fill the rated order. Individual ratings granted by the WPB are on form PD-1A, while those granted by the Army, Navy, Maritime Commission and other war-buying agencies (subject always to WPB review) are on form PD-3A.

Use of PD Forms Restricted

Use of these forms is being steadily restricted. WPB is throwing most requests for priority assistance under PRP or MRP and limiting use of PD-1A to priorities on capital goods. It's likely that the authority granted the armed services to issue PD-3A ratings will be similarly curtailed or even eliminated. These PD-3A ratings, issued in large quantities, obviously upset the careful scheduling of materials involved in WPB's operations under PRP. WPB can never hold down the total of ratings issued to the amount of the available supply if someone else is issuing ratings at the same time. It's like a man and his wife trying to operate a joint checking account.

P orders grant a priority rating to a whole class of purchases. Usually it authorizes an important industry—such as aircraft or freight car builders—to apply a specified rating to all its purchases. Most of these blanket P orders have now expired or have been canceled, and the industries that had them are operating under PRP.

The M, or materials orders, in general, are directed to material producers. They tell the producer how to dis-

tribute his product. In some cases, M orders forbid certain uses of a product. Thus order M-9-c contains a long list of products in the manufacture of which the use of copper is forbidden.

M orders are still being issued, and there will be many of them in force for some time to come. But to an increasing extent their functions will be eliminated by allocations under the PRP-ACS program.

The L, or limitation orders, were chiefly important during the first six months or so after the start of the war—the period of forced conversion. These orders, generally, tell you not to make something. They are the orders which stopped automobile production. The typical order might establish monthly production quotas for some metal gadget until some date in May, June, or July of 1942 and prohibits production thereafter. Quotas may limit number of units, dollar value, or metal consumption.

Some L orders do more specialized jobs. They may limit sales to certain classes of customers or to orders bearing high priority ratings. They may forbid or limit use of certain materials in a product. They may limit production to certain standard sizes.

By and large, the only L orders you need to know about are those that are directed at your own industry.

Chapter Five ★ ★ ★ ★

NEED CAPITAL?

Capital for war production is of two types. Physical production facilities—anything from a sewing machine to a mile-long factory—constitute one kind; the other is money. Both are under wartime controls.

The basic control over physical production facilities is exercised by WPB; virtually every individual expansion of plant and equipment must be inspected and approved by that agency. Priorities and preference ratings on that kind of capital goods expansion are handled on a project-by-project basis; they are not granted under any of the broad schemes such as the Production Requirements Plan or the Maintenance Requirements Plan.

Small plant expansions, involving the installation of individual new machines, get a priority rating as a result of applications made on PD-1A forms, which can be obtained from a bank or WPB field office. This application form (when this is stamped "approved" it becomes a priority rating for purchase of the particular item) must be filled out and submitted to WPB's Bureau of Priorities in Washington. If you are in doubt about how to do this, you can get help at priority field offices of WPB. These field offices cannot grant ratings, however; they only give advice.

At present, the Army, Navy, and Maritime Commission also grant ratings on new machinery and plant, using the similar PD-3A form. It is probable that this power will soon be taken away from them. Meanwhile, however, if you are a prime contractor, you can get this sort of priority assistance by working through the procurement officer in charge of your contract.

WPB Handles Large Expansions

Larger facility expansions—a whole new factory, for example—are handled also on an individual basis by WPB. But the board does not require a separate PD rating for each individual purchase. Instead, application is made on form P-19 for a limited blanket rating, which entitles the builder to apply that rating to all purchases made in connection with a specific project; blueprints of the project are made a part of the P-19 document.

Money is the one war commodity of which there isn't and won't be a scarcity. In all new credit systems which the government has established, the emphasis has been not on restricting credit to certain purposes but rather on making money more readily available for war work.

Your first points of contact in getting war credit can well be your own bank and the corps of financial advisers named by WPB's Bureau of Finance. These federal advisers do not make any loans themselves, but they are familiar with the various means by which war contractors and subcontractors can get financial help. They'll tell you whom to see, what forms to fill out.

If your own bank is able and willing to meet your needs at reasonable rates, you are likely to find this the simplest and quickest way to get money, but it is not necessary to use your own money or credit to finance your war plant facilities. There are several procedures by which you can arrange to have the government pay for it. If you are a prime contractor and need a few extra machines to execute a contract, you can arrange with the procurement officer to include in the contract a provision for government purchase of the machines you need; then you can use the machines and pay rent to the government.

Government May Build Plant

For larger plant expansions the Defense Plant Corp., an RFC subsidiary, offers the preferred arrangement. Under this scheme you build or buy the facilities with DPC funds. Title to the new facilities remains in the Defense Plant Corp., though you have an option to purchase after the war. You will pay a rental to DPC for the use of the facilities.

If you are a prime contractor, the rental will be $1 a year plus maintenance and insurance. But the price you charge the government on your prime contract cannot include anything for plant construction costs. If you are not a prime contractor, the rental will be based on value of the plant and depreciation rates.

Requests for DPC assistance are initiated through either the armed services or through WPB. Prime contractors anxious for aid should approach the procure-

Where to Get Money

Regional advisers from WPB's Bureau of Finance have no money to lend war contractors, but they know where it can be had.

CITY	NAME	ADDRESS
Atlanta Region		
Atlanta	Clarence Knowles	116 Chandler Bldg.
Jacksonville	James J. French, Jr.	730 Lynch Bldg.
Knoxville	A. P. Frierson	204-205 Goode Bldg.
Memphis	St. John Waddell	2112 Sterick Bldg.
Boston Region		
Boston	Fred R. Hall	17 Court Street
Hartford	Edward R. Barlow	Phoenix Bank Bldg.
Providence	Ralph H. Koelb	530 Industrial Trust Bldg.
Chicago Region		
Chicago	Harry R. Kimbark	20 No. Wacker Drive
Indianapolis	Henry Ketcham	Circle Tower Bldg.
Milwaukee	Paul P. Robinson	7048 Plankinton Bldg.
Cleveland Region		
Cleveland	Frank Gibson	Union Commerce Bldg.
Charleston	F. O. Lamb	24 Capital City Bldg.
Cincinnati	Justin J. Stevenson	804 Union Trust Bldg.
Louisville	Joseph T. Simmons	200 Todd Bldg.
Pittsburgh	Mark Grubbs	405 Fulton Bldg.
Dallas Region		
Houston	O. W. Jackson	1016 Walker Ave.
New Orleans	G. L. Woolley	423 Canal Bldg.
Denver Region		
Denver	Robert W. Frye	708-714 Kittredge Bldg. 16th & Glenar Sts.
Detroit Region		
Detroit	Charles W. Renfrew	7310 Woodward Ave.
Kansas City Region		
Kansas City	Alexander Silberberg	508 Mutual Bldg.
St. Louis	R. Jewett Jones	943 Paul Brown Bldg.
New York City Region		
New York City	Erwin Rankin	122 East 42nd St.
Buffalo	H. L. Underhill	212 M & T Bank Bldg.
Newark	Walter H. Hick	Globe Bldg.
Syracuse	Richard Robertson	224 Harrison St.
Philadelphia Region		
Philadelphia	W. W. Moss	1617 Pennsylvania Blvd.
Richmond	Phillip Goodwin	Johnson Publ. Bldg. Fifth & Cary Sts.
Minneapolis Region		
Minneapolis	Guy F. Jensen	326 Midland Bldg.
San Francisco Region		
San Francisco	Leonard Woolams	1355 Market St.
Los Angeles	Frank C. Mortimer	1031 South Broadway
Seattle Region		
Seattle	Geo. W. Klinefelter,	239 White-Henry-Stuart
Portland	A. C. Ruckdeschel	815 Bedell Bldg.

ment officers with whom they deal on their supply contract. Others should start with the nearest WPB financial consultant. Then the Bureau of Finance will clear the matter through WPB and make initial contact with Defense Plant Corp. At this point you will submit a formal application to DPC.

For the particular benefit of smaller firms, a service similar to that of the DPC will be offered by the Smaller War Plants Corp., now being organized in WPB. Procedures are not yet worked out, but when they are established you can find out about them through the local financial consultant.

If you do put your own money into new war plant, you are entitled to special tax concessions. Each year, for five, you may deduct from your net profit, when figuring taxes, a fifth of the cost of new facilities. That is, for tax purposes you may amortize plant in five years.

To get this tax-deduction privilege, however, it really has to be your own money that is invested in the plant. Before the Army or Navy will certify your plant for rapid amortization, you will have to satisfy them that the prices you are charging the government on any prime contract do not include any item for plant beyond normal depreciation and wear and tear.

To qualify for rapid amortization, you must obtain from the Army or Navy a "Certificate of Necessity" certifying to the Treasury Department that your new facilities are really necessary for the war. You can apply for this Certificate any time within six months after you start building the facility.

Credit Comes Easy

If you are working on goods destined for the Army or the Navy, obtain an application form from the War or Navy Department, as the case may be, and submit it to Washington. You can also obtain an application from the Bureau of Finance. If you are not working directly for either service but feel that your new facilities are important to the war effort, you may still submit an application to one of the two departments.

To get working capital you have to use your own credit. But if the job you are doing is important to the war effort, your credit doesn't have to be very good. There are several arrangements for getting working capital on easy terms.

It is now legal to assign a government contract as security for a loan. Thus, if you are a prime contractor you can very likely obtain a loan from your own bank on the security of your contract. In writing the contract, you may avoid future trouble by inserting a clause specifying the kinds of assignment that will be permitted.

If your bank isn't interested, the RFC may be able to help you. Loans are now made to corporations engaged on war work without the usual RFC insistence on sound security. Application is made through field offices of the RFC (get the address of nearest one from your bank). Loans up to $100,000 are made directly in the field. Larger loans are referred to Washington for approval. Loans carry 4 percent interest.

To encourage banks to make war loans, the Army, Navy and Maritime Commission now have worked out a plan with the Federal Reserve by which the bank will be guaranteed against loss. Your own bank can approach the Federal Reserve on this, or you can go directly to the nearest Federal Reserve Bank. In either case, the application will be reviewed by one of the services as to the war urgency of the loan. Interest on these loans runs to 5 percent. In exceptional situations Reserve Banks can also make direct advances to provide working capital.

Prime contractors have still another possibility. They may obtain advance payments on their contracts up to

30 percent of the uncompleted value of the contract. Interest rate on these loans is 2½ percent. To get such an advance, work through your procurement officer.

In some cases, subcontractors can obtain advances from their prime contractors. If the prime contractor is making such advances, the Army or Navy will increase the amount of its advance to him to 50 percent of the value of the contract.

The Smaller War Plants Corp. will be empowered to make loans, particularly to subcontractors and other small firms. This system is not designed to replace any of the existing credit patterns but rather to handle marginal cases that don't fit into any of them. For instance, situations sometimes arise in which a firm can't get a contract unless it has credit and can't get credit unless it has a contract. SWPC will try to resolve such an impasse as this.

Chapter Six ★ ★ ★ ★

FINDING WORKERS

Of the elements entering into production, manpower is still the least tightly controlled. Thus far supply of manpower has occasioned little difficulty. There have been shortages of critical skills here and there, but only now is a real shortage of labor showing up. By the middle of fall it's likely to be squarely on us.

In the absence of legal authorization for labor allocation, the War Manpower Commission has two major tools at its command for putting people where it thinks they ought to be—the Selective Service System and the U. S. Employment Service.

Selective Service is usually thought of simply as a means of getting men for the Army. Actually, it is designed as a device for placing men in positions where they will contribute most to the war effort, whether that be the Army or war production. In the exercise of this discretionary function, the system has not always functioned with a maximum of precision because of the large amount of authority given the local boards. The status of critical workers is always precarious, for their deferment from the Army must be only temporary.

Selective Service has a two-way effect on industrial employment. On the one hand, safeguards are set up so that the Army will not strip essential industries of irreplaceable men. On the other hand, the threat of Army service is used to push men from non-essential into essential jobs.

Deferments are granted to employees in two types of industries—those directly involved in the war (the munitions industries) and those civilian industries which have to be kept going if the nation is to be economically healthy enough to carry on a war. These last are the basic industries like food, clothing, and transportation.

Fundamentally, the decision as to what industries are directly or indirectly essential to the war effort and what occupations in these industries are critical is up to the local draft boards. The Selective Service System, however, is issuing advisory rulings on certain industries. These point out the importance of the industry and list the occupations in it which appear to be critical. Such rulings are prepared in consultation with the industry and with interested government agencies.

If your industry is not already covered by such a ruling and you think it ought to be, take up with your trade association the question of approaching Selective Service on the matter.

At the direction of the War Manpower Commission, the U. S. Employment Service is already operating a partial system of labor priorities. That is, when several plants ask a USES branch office for men, the Employment Service fills first the requests coming from war-important plants. WPB furnishes the service with information as to the importance of different plants.

Obviously, all that is needed to transform this method into a rather thoroughgoing set of labor priorities is the requirement that all plants obtain their labor through USES. First steps in this direction are now being taken.

This is the famous job-freeze; and this is all it amounts to as yet. In operation, it means that a worker will not leave one war plant in a shortage area and go to another war plant without the approval of the Employment Service.

If such a system is to work without creating a vast amount of resentment, wages paid in different war plants for the same skills must not reflect too great discrepancies. This problem is recognized, but no satisfactory approach to its solution is yet clearly in sight.

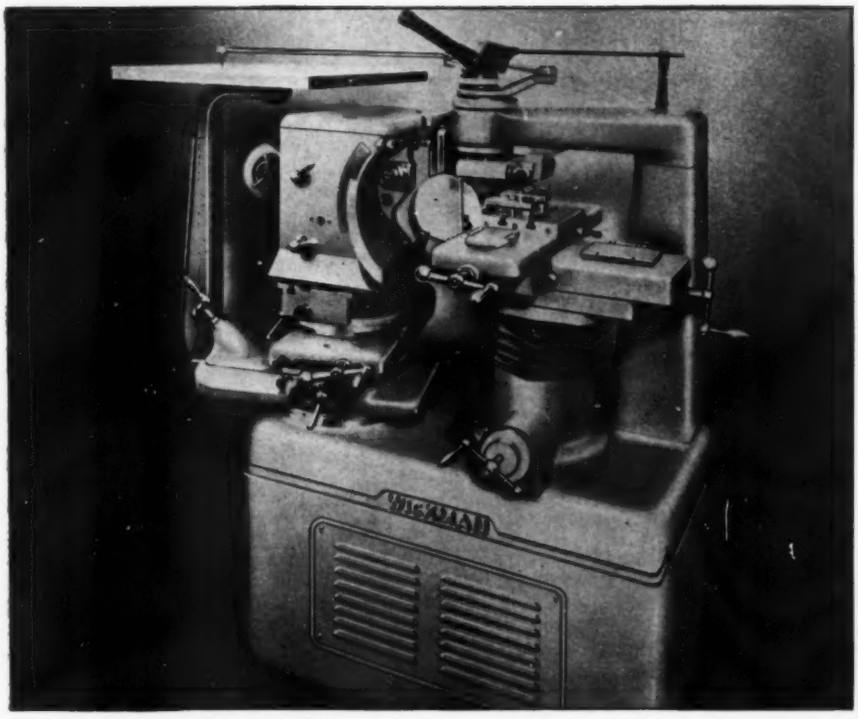
Through the second half of 1942, compulsory resort to USES in all hiring will spread from area to area, will eventually become universal. According to present intention non-war plants will be exempted, on the theory that the pressure of Selective Service plus the generally higher wages of war industries will prevent any raiding of war plants by civilian plants.

This general system has the advantage that it can operate without any direct compulsion on the individual worker—simply by making it easier for him to do what he's supposed to do. Whether this is as far as the War Manpower Commission will have to go depends on the stringency that develops in labor supply. If things get too tight, Congress will undoubtedly be asked to authorize direct routing of individual workers.

Reprints of this section are available at 10 cents each while they last. Write *American Machinist*, 330 W. 42nd St., New York City

SHOP EQUIPMENT NEWS

Wickman Optical Form Grinder Incorporates Microscopic Inspection for Profile Grinding



An optical form grinder, sold and serviced by the Wickman Corp., 15533 Woodrow Wilson Ave., Detroit, Mich., is manufactured by the Sheffield Corp., Dayton, Ohio. Equally adaptable to the grinding of tungsten carbide and hard tool steels, it will finish grind to a high degree of accuracy flat or circular form tools, punches and dies, profile gages, templets and many other regularly or irregularly shaped parts.

The machine is a combination of a full universal tool grinder with a pantograph-controlled optical checking instrument. The grinding head carries a wheel slide which moves up and down at 80 strokes a minute across the contour of the part to be ground. The work is clamped to the table and its position controlled and set by compound slides.

A 50:1 layout is fastened to the layout plat located above the machine. This plat is adjustable and may be locked so that its position will be unchanged while grinding is in progress. A 30-power microscope is carried on the short arm of the pantograph and is arranged with rotating cross hairs, the intersection of which corresponds to the position of the pointer on the long pantograph arm.

The wheel head assembly can be adjusted to any desired position or angle by three radial slides, and its path across the contour of the work is manually determined by lateral and longitudinal cross-slides.

The 2 in. stroke of the wheel permits a number of thin pieces to be stacked together. The machine will grind a form 5¾ in. long and 2⅜ in. deep in parts 2 in. thick. The layout size is 20 in. square which makes possible grinding an area 0.400×0.400 in. in one setting. Profiles greater than 0.400 sq.in. in area can also be handled by special methods.

Reversing the procedure with the same equipment it is possible to inspect the part without taking it out of the machine. It is also possible to record or transfer the contours of a part on a drawing 50 times its size, thus producing an accurate layout of any form for which no detail drawing is available.

All necessary equipment for grinding flat work, including electrical equipment for regular a.c., and a wheel dresser capable of dressing straight faces to any required angle are provided as standard equipment. The machine is provided with upper and lower lights to illuminate the work. A completely filtered exhaust system is built into the base. It may be removed and washed at any time. A separate motor-driven circular grinding attachment is available for use on cylindrical work such as circular form tools, in which case reciprocating motion is not used.

The entire machine, including the layout plat, occupies a floor area 6¼×45¼ in.

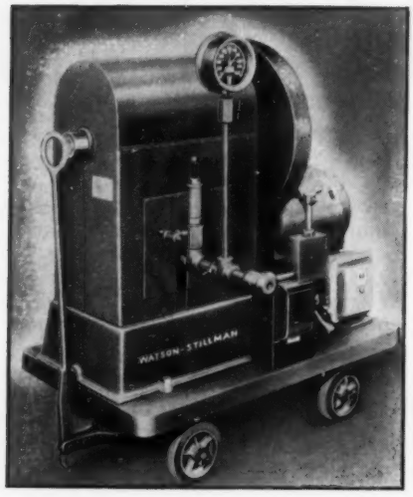
Gisholt Portable Balancing Unit Detects Parts Unbalance

A portable balancing unit, capable of one-man easy transfer is being offered by Gisholt Machine Co., 1201 East Washington Ave., Madison, Wis. This simplified "Wattmeter" type balancing unit was designed by Westinghouse Research Laboratories to detect unbalance in large rotating parts of special design without disassembly from their parent machines, making possible easy correction and maintenance of proper

balance, under actual operating conditions. Special machine parts, in small quantities, with rotating speeds from 100 to 10,000 r.p.m. can be checked for unbalance with this unit, which indicates both phase angle and amplitude of vibration. From these readings, locations where corrective weights are needed may be readily determined.

Watson-Stillman Test Pump Mounted on Portable Truck

A 3-plunger vertical motor-driven portable test pump has been introduced by the Watson-Stillman Co., Roselle, N. J. This pump develops 8,200 lb. per sq.in. maximum pressure and is used for testing boilers, tubing and all kinds of high pressure vessels. The entire unit, including motor, is mounted on a hand truck for portability and all parts are inclosed for protection. The plung-

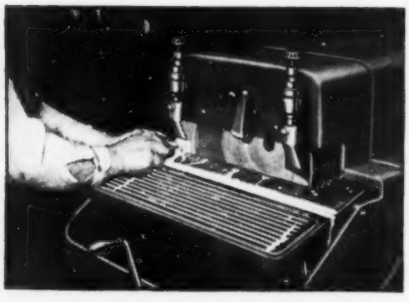


ers have ½ in. diam. and 2 in. stroke. A 3 hp. motor drives the pump at 100 r.p.m.

Equipment includes pressure gage, safety valve, needle valve for pressure regulation, motor, motor starter, disconnect switch and 25 ft. of rubber cable. The entire unit is 50 in. long, 30 in. wide, 48 in. high and weighs 1,450 lb.

Wheel Guards Added to Hammond Tool Grinders

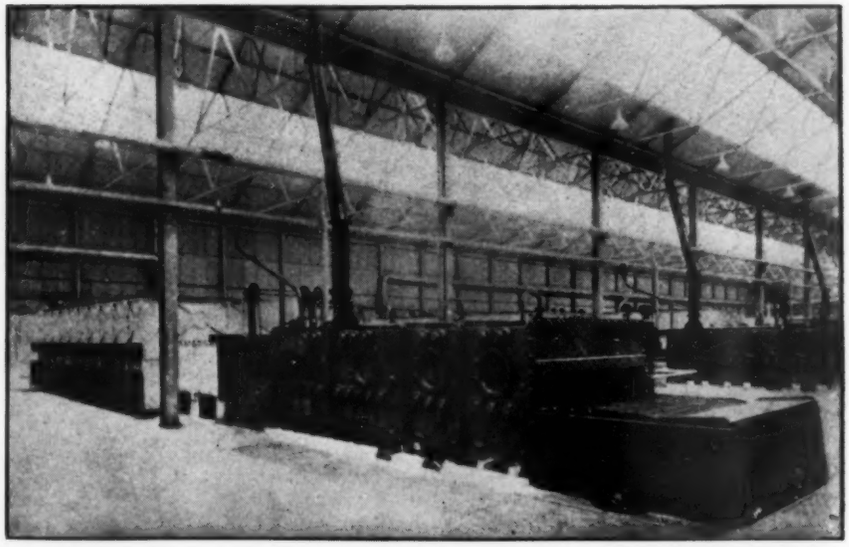
Scientifically designed wheel guards known as No-Spray—No-Splash have been installed on Models 10 and 14 in. carbide tool grinders it is announced by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. These guards are concealed and are close to the wheels, thus providing the operator with the maximum amount of light and fullest operating freedon. They are easily rotated from one side of the wheel to the other by a handle, quickly accessible. As an integral unit,



the hood and the table mechanism, protected from ingress of dust and grit, is mounted on inclosed shaftways and is moved in or out from the wheel by a convenient crank, providing a quick means of adjustment for wheel wear and wheel changes. Tables are mechanically controlled by a crank and worm tilting mechanism adjustable to any point between 15 and 30 deg. below horizontal.

Hanson-VanWinkle-Munning Handles Curran Automatic Type Equipment to Anneal and Pickle Brass Shell Cases

The Hanson-Van Winkle-Munning Co., Matawan, N. J. has been appointed sole sales representative in the United States for automatic type equipment for annealing and pickling of brass shell cases developed by Curran Bros. Ltd., Cardiff, Wales. A typical installation includes a pickling chamber placed at the discharge end of a gas-heated muffle furnace so that cold-worked



articles can be loaded on conveying mechanism at the mouth of the furnace and need not be touched by hand until they emerge at the other end of the plant annealed, pickled, washed and warmed so that they dry very quickly. Pickling chambers are lined with rubber and have a number of zones in each of which the work passes through high pressure sprays, first of acid and then of hot water directed upon it from a number of directions from a frame of fine jets. The acid is heated by steam coils made of acid-resisting alloy placed in a main reservoir. Usually hot sulphuric acid is used for both brass and steel. Hydro-chloric acid can be used when no heating is employed. The plant can be used for any metal which can be pickled by either of these acids.

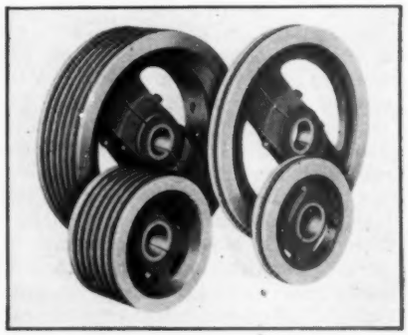
Units of this kind need not necessarily be made a structural part of an annealing furnace because arrangements are such that no acid fumes emerge from either end of the chamber. This equipment is designed for handling shells of 37 mm. or larger. It includes the necessary pumps, filters, annealing furnaces and pickling unit.

The average pickling time in the sulphuric acid solution is 4 min. and in the majority of cases the complete operation can be performed in 100 min. Many items other than shells can be annealed and pickled.

Dodge Wood Sheaves For V-Belt Drives Can Replace Metal

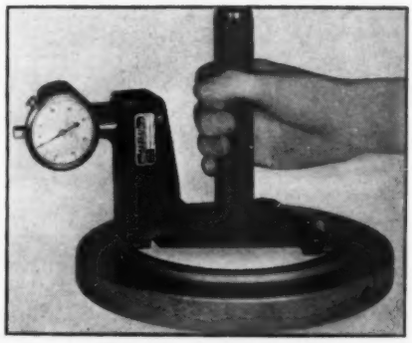
As an alternate for metal sheaves the Dodge Mfg. Corp., Mishawaka, Ind., has produced the "Victory" wood sheave for V-belt drives. It is claimed that the efficiency of this sheave is equal in every way to that of metal sheaves except where flywheel effect is essential. It is of laminated construction and the segments are of selected straight-grain kiln dried hard maple. Wood bushings are provided and provision is made for firm fastening to the shaft.

These sheaves are offered in composite groove types for A and B section belts in a full range of sizes,



and for B belts in sizes from 5.4 P.D. to 38 P.D. up to 10 grooves, and for C belts from 5.4 P.D. to 44 P.D. up to 12 grooves.

Federal Products Indicator Gages Check Shallow Holes, Gear Drive Diameters, and Inspect Bearing Face Distance

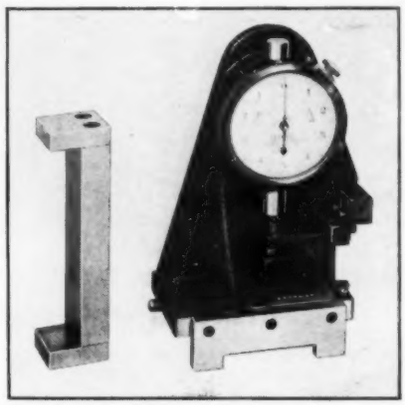


Motion of the sensitive contact in this inside diameter gage for shallow holes is carried back to the indicator through a spring hinge

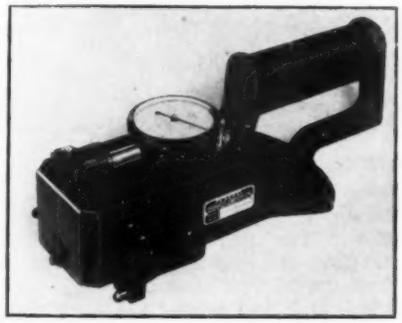
Three new models of indicator gages have been introduced by Federal Products Corp., 1144 Eddy St., Providence, R. I. The Model 167 P-75 inside diameter gage checks shallow holes and recesses of 6.80 in. diameter. It is set back away from contacts to clear obstructions on the machine. Motion of the sensitive contact is carried back to the indicator through a spring hinge, thus eliminating all lost motion. The gage is sensitive and accurate for tolerances in tenths of thousandths.

An inside diameter gage, the Model 167 P-71, is designed to check the inside diameter of a gear accessory drive used in an airplane motor. It consists of a fixed contact in the rear under the handle, and a sensitive contact on the front. A locating contact on each side is mounted on a centralizing yoke, which is spring suspended. Lost motion, friction or other factors which would cause inaccuracy or loss of sensitivity is eliminated because the motion or travel of the sensitive contact point is carried directly to the indicator. The diameter capacity is 7.80 in.

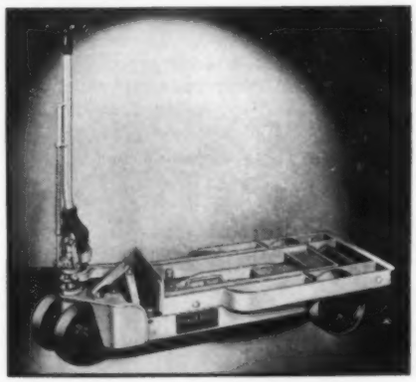
The Model 294 P-26 gage is used for inspecting the distance between faces of crankshaft bearings. The sensitive contact point at the right of the base is mounted on a triangular piece which is supported on flat springs, allowing it to transfer the motion to the indicator without friction or lost motion. The latter can be controlled by the screw and check nut below the indicator point.



The contact point on this gage for inspecting distance between faces on crankshaft bearings transfers motion to indicator without lost motion



The inside diameter of a gear accessory drive used in an airplane motor is checked with this gage



Heavy Loads Easily Handled With West Bend Lift Truck

Designed for easy mobility and greater efficiency in handling extremely heavy loads, a 10,000-lb. capacity Weld-Bilt hydraulic lift truck, Model L, is announced by West Bend Equipment Corporation, West Bend, Wis. Made in both narrow and wide platform sizes, the Model L lift truck has frames, wheels, lifting mechanism of extra heavy construction, capable of much heavier load than the specified rating. Moving parts are equipped with ball or roller bearings for easy handling. Steel frames are completely arc welded and heavily crossbraced for extra rigidity and strength. It is available in a variety of sizes.

Control for Machine Tools Permits Contour Machining

A semi-automatic control for machine tools that permits contour machining with standard machine tools at considerable speeds and accuracies has been introduced by the Detroit Universal Duplicator Co., 253 St. Aubin Ave., Detroit, Mich., known as the "Duplimatic."

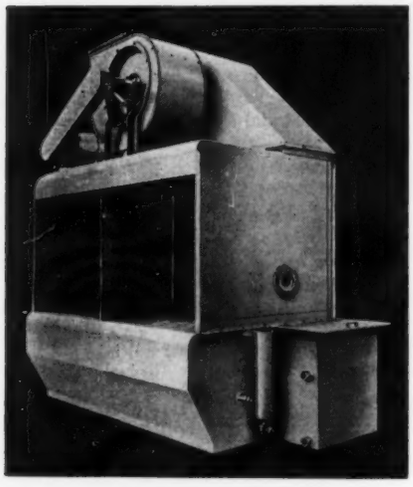
Illustrated is an application of this unit on a Reed-Prentice vertical milling machine. It controls both the transverse and longitudinal feeds in much the same manner as an operator would in using manual control alone. Manipulation of feed screws by the control is in accordance with the outline of a templet which is mounted on the table with the work. A tracer mounted on the head of the machine is connected with the control so that during the operation the control moves the table so that the templet always touches the tracer finger with prede-

Contour machining with standard machine tools at considerable speeds is possible with this semi-automatic control

termined and exact amount of pressure. Since the sensitivity of the touch is exact, the instant the movement begins to reduce or increase the pressure between templet and finger the control immediately reverses the travel and reestablishes the proper contact. The Duplimatic is portable and can be moved to other equipment.

Safety Factor Increased in Hydro-Whirl Magnesium Booth

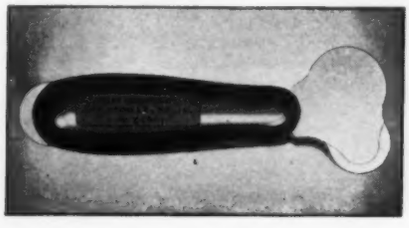
Improvements have been made by Industrial Sheet Metal Works, Detroit, Mich., in its hydro-whirl magnesium booth. The safety factor has been stepped up beyond former high efficiency. Instead of being made of steel the bench grating of the compartment where the work is done is made of hardwood, which will not produce



sparks if struck with a grinding wheel or tool. Thus the possibility of having sparks ignite the magnesium dust created by the grinding, buffing or polishing operations performed within the booth is removed and danger of fire is practically eliminated. Masonite lines the booth sections as an added protection against spark ignition. An automatic control maintains the water level at a uniform height in the tank below the grating.

Single Driver Will Operate Three Sizes of Dzus Fasteners

A single driver, designed to operate three sizes of Dzus fasteners, has been announced by Products Engineering Company, 700 E. Florence Ave., Los Angeles, Calif. It is a multiutility tool



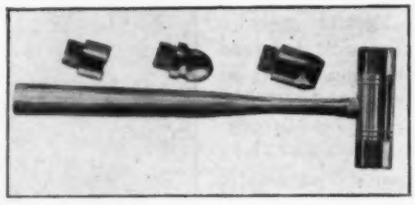
that replaces three special drivers, being adaptable to large, medium and small fasteners. The body of the tool consists of cadmium plated heat-treated chrome-moly steel and the handle is made of specially constructed non-breakable, shock-resisting plastic.

Superior Instrument Co. Tester Has Sensitive Danger Indicator

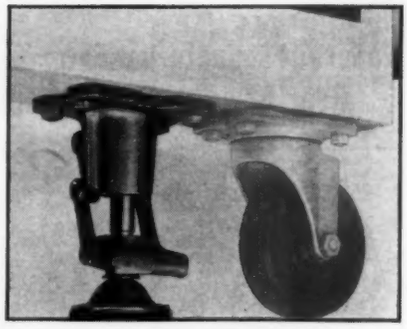
A super-sensitive danger indicator features the Model 520 insulation and breakdown tester produced by Superior Instruments Co., 227 Fulton St., New York, N. Y. It lights up to indicate leakage up to 1,000 megohms. No hand cranking and no adjustments are necessary. By simply connecting the two test leads to the circuit, appliance or motor to be tested and throwing the switch the tester is ready for use. The danger indicator will instantly light up to indicate defective insulation or a potential breakdown. The instrument operates on any 90 to 125 volt 60 cycle a.c. line, and is 6×8×4¾ in. in size.

Southwest Mfg. Co. Mallets Made With Pyralin Tips

Pyralin tipped mallets have been introduced by Southwest Mfg. Co., 1623 E. First St., Santa Ana, Calif., with the threaded tip replaceable by hand. The handle is made of hardwood and an oval hole drilled in the head of the hammer prevents the handle from turning or coming off. The head of



the mallet which is solid brass is threaded at both ends and can be replaced simply by screwing in the new tips by hand. These mallets are furnished in sizes from ¾ to 2 in. with cross or ball peens to correspond.

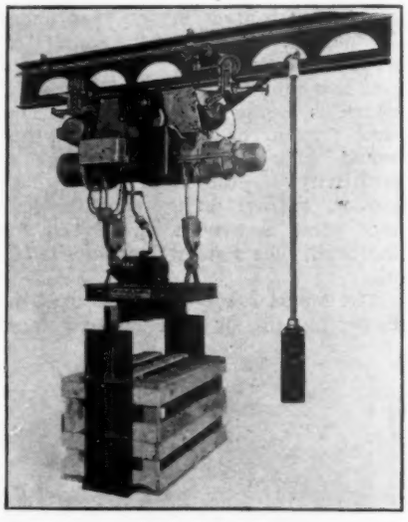


Bassick Floor Truck Lock Holds Truck Firmly in Place

A positive-position floor truck lock to hold the truck firmly in place in a desired position has been announced by the Bassick Co., Bridgeport, Conn. Bolts fasten it to the under side of the truck, preferably in a protective position as near as possible to the caster wheel. An easy downward pressure on the foot lever sets the shoe in contact with the floor, and with a very slight upward pressure by the toe under the lever the lock is released. Springs give it a constant and predetermined locking pressure and also a range of action through which this pressure is effective. The approximate weight of the device is 10 lb.

Cleveland Tramrail Grab Handles Crates and Boxes

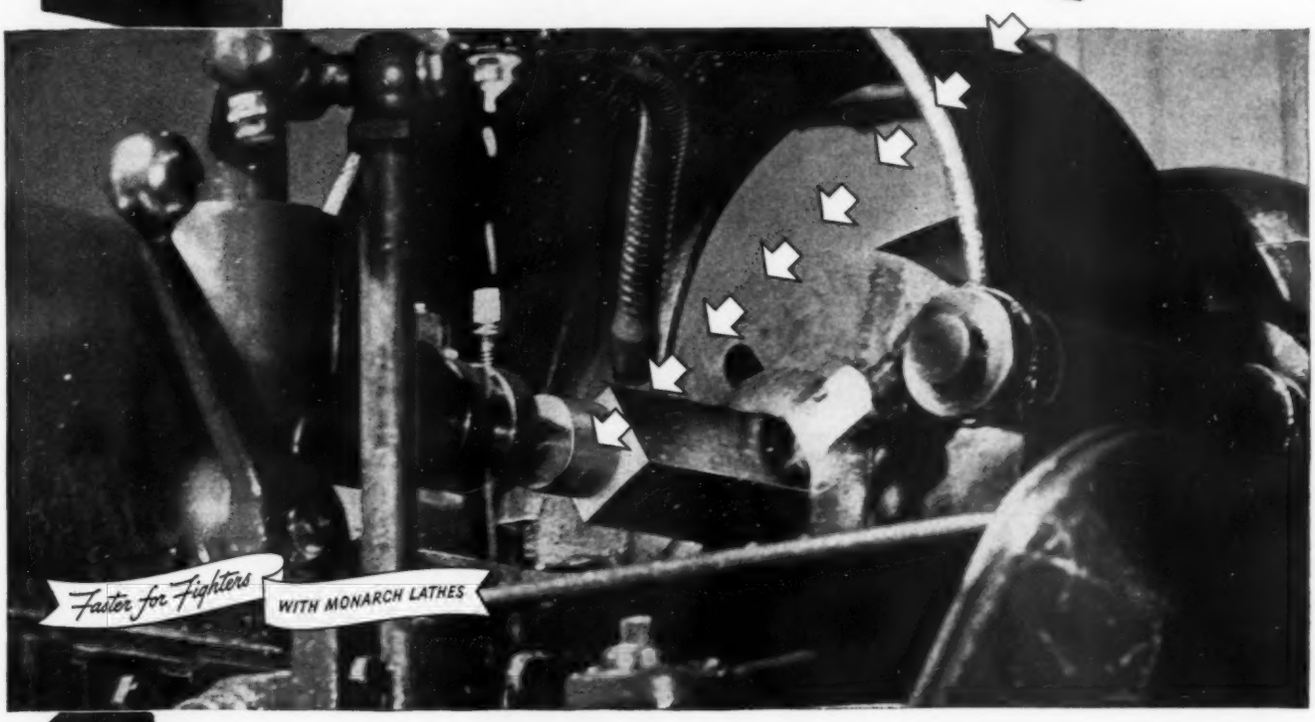
A motor driven crate grab and carrier has been developed by the Cleveland Tramrail Div., Cleveland Crane & Engi-



neering Co., Wickliffe, Ohio, for handling crates and boxes in and out of storage or from one elevation to another. The unit enables the quick stacking or removal of crates at a great height with safety.

The grab and carrier are completely motorized with all operations conveniently controlled by the six buttons of the push-button station. The arms of the grab are extended and retracted

1948 BLOWS PER MINUTE



. . but the Monarch Lathe can take it!

Turning square stock with an interrupted cut puts a heavy strain on the lathe—especially at high speeds. The stud illustrated is cut from 1⅞" square stock (SAE-1020), with a Tungsten Carbide tool, at a speed of 487 RPM—creating 1948 hammer blows per minute.

But the Monarch Model W Lathe takes this work in its stride. Its design and structural strength provide the rigidity to take this interrupted pounding action. Bearings of adequate size support the main spindle and other shafts. The bearing area of the carriage on the bed, and the bearing area of the compound rest to the carriage are designed in correct proportion to provide the rigidity to stand up under such heavy punishment.

Yet the same lathe that takes, without flinching, these rough interrupted cuts performs the finest of finishing operations with unfailing accuracy.

Therein lies much of the utility of Monarch Lathes of today—which you can continue to depend upon to do your turning work—tomorrow.

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

COVER THE TURNING FIELD

by means of geared slide bars driven by the motor mounted on top of the grab. Power is supplied to the motor through a flexible cable held taut by a spring-type retrieving reel. A double-hook cable type electric hoist elevates and lowers the grab with very little swing. A quick acting electric brake stops and holds the load wherever desired.

Bijur Solenoid Lubricator Adaptable to Any Machine

The Bijur Lubricator Corp., 22-08 Forty-Third Ave., Long Island City, N. Y., has announced a solenoid-operated lubricator adaptable to any machine layout. The illustration shows the pump mounted on a cover-plate and completely accessible by removing this

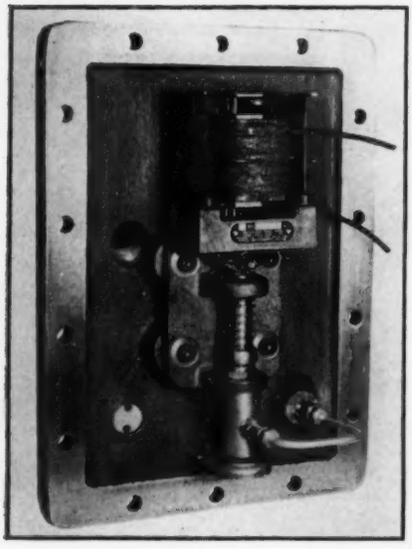
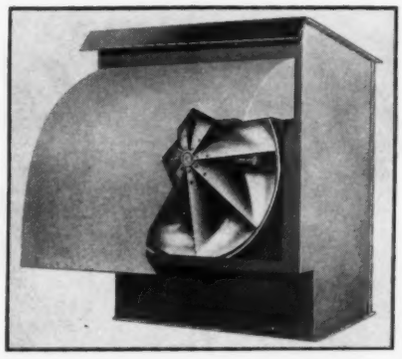


plate. Pump-and-reservoir unit together with branched oil feedline, junctions and meter-units at the bearing surfaces comprise the system.

The system operates by a switch connected to one of the machine slides which energizes the solenoid on the return stroke after completely machining the work. At the end of the return stroke the current to the solenoid is automatically shut off, the lubricator pump piston descends and oil is delivered through the distribution feedline tubing to the eight meter-units. Each meter-unit feeds a predetermined and correctly-proportioned quantity of oil to the bearing surface it serves. Meter-units can be located at any distance, height or level in relation to lubricator position.

Ilg Power Roof Ventilator System Features Blackout Hood

Power roof ventilators with blackout hoods have been announced by Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill. Each ventilator consists of a galvanized steel weather-tight penthouse equipped with a door



at the back providing access to the fan for periodical oiling. The self-cooled motor-propeller fan inside the penthouse ranges in size from 12 to 72 in. The blackout hood is painted black inside and out to prevent light from penetrating, without air obstruction.

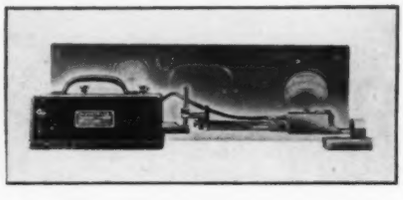
Kirk & Blum Down Draft System Carries Off Dust

A down draft system of dust control has been announced by Kirk & Blum Mfg. Co., Spring Grove Ave., Cincinnati, Ohio, which is constructed to carry off dust through ducts under the floor thus saving floor space. Bench-high gratings through which air is exhausted enable operators to conveniently handle castings for sanding, snagging, grinding, polishing and buffing. All

dust particles are carried down through the gratings as fast as they are released. It is possible to grind and sand castings within a few feet of precision machinery without the necessity of partitions or curtains.

Profilometer Accessory Does Mechanical Tracing of Finish

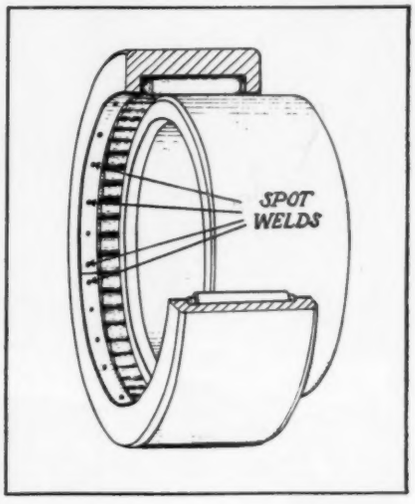
A newly designed Mototrace, an accessory used with the Profilometer for mechanical tracing of surface finish,



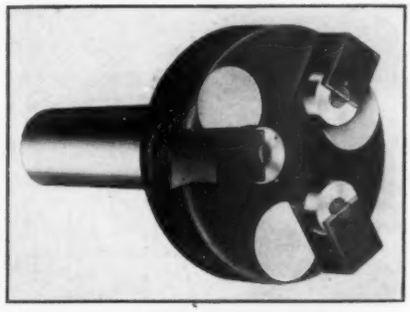
has been announced by the Physicists Research Co., 343 S. Main St., Ann Arbor, Mich. The new unit has a 9-watt driving motor, with which a stroke from 1/32 in. to 2¾ in. can be obtained. Provisions have been made so that if the motor should become locked, it does not heat up and the motor is not damaged. All operations are controlled by the power switch and two adjustable stops. The unit is used for securing accurate reading on fine surfaces.

Bantam Bearing Retaining Rings Now Installed by Spot-Welding

An improved method of installing the roller retaining rings of the Bantam quill bearing by spot-welding has been announced by Bantam Bearings Corp., South Bend, Ind. It is claimed that



this method not only gives a sturdier, more permanent assembly, but considerably speeds up production of this anti-friction unit. The large number of small diameter rollers are held in place in the outer race by retaining rings. In addition to simplifying the machining operation the new spot-welding method gives a positively located and permanently placed band which will not snap loose under any ordinary conditions.



Smoother Surface Produced by Boyar-Schultz Burnishing Tool

Announcement of the Model "C" burnishing tool for external cylindrical sur-

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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

OPEN-HEARTH MEN SPEED PRODUCTION OF FIGHTING STEELS

These men of the open-hearth steel furnaces move into action like army engineers working under fire. Swinging their shovels in determined, fighting rhythm they heave dolomite through the flame-licked door—making "bottom" in their furnace—preparing it for another charge of molten iron and steel scrap. Within minutes the furnace roars at white heat to produce more fighting steel for ships, planes, tanks, shells, guns, bombs . . .

On the charging floor at this battery of open-hearths, workmen are making steel at a fighting pace—a pace that prevails in all departments of the works every hour of every day—speeding every ton of it on the way to help win the war. By their skill and sweat these men of steel are doing what once seemed unbelievable—getting production from their furnaces and mills greater than 100% of their rated capacity.

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PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

faces has been made by Boyar-Schultz Corp., 2110 Walnut St., Chicago, Ill. It is easily and quickly adjusted to produce a smoother surface than the usual machined surface, and in many instances eliminates an extra operation. The tool is available in three sizes.

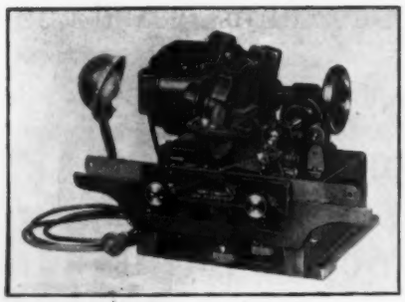
R-S Standard Bearing Covers Make the Housing Dust-Tight

Ball and roller bearing standard covers have been developed by R-S Products Corp., 4530 Germantown Ave., Philadelphia, Pa., for forming a dust and grease-tight closure to the bearing housing. Chief advantages of these

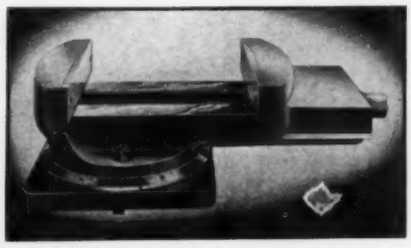
covers are low unit cost in small or large quantities, the saving of costly "nuisance" set-ups, reduction in designing, drafting, detailing and checking time as well as the entire elimination of the costs of patterns, fixtures, gages and so forth.

Howe Saw Blade Sharpener Reconditions Wide Range

The Howe-Lindsey automatic sharpening machine for sharpening and reconditioning hack saw blades and band saw blades is available with an attachment for circular rip or metal saws. Manufactured by Howe & Son, Inc., Hinsdale, N. H., this compact machine, with a minimum of attachments consistent with its range of work, can handle circular, rip or metal saws up



to 20 in. diameter, and any size hack saws or band saws. Indexing, or the movement of the teeth past the grinding wheel, is accomplished by a double pawl arrangement which eliminates any stoppage due to a broken saw tooth, the "broken tooth" space passing under and beyond the wheel in the same manner as the perfect teeth.

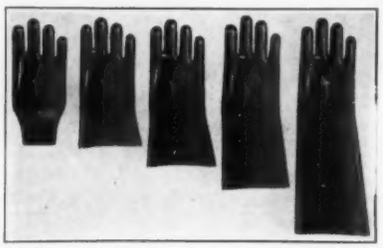


Rousselle Vise Combines Large Size With Accuracy

The Rousselle "Victory" vise made available by the David J. Ross Co., 101 Ross Park, Benton Harbor, Mich., combines large size with accuracy to 0.001. Besides accuracy and ruggedness the vise also features extra clearance for full freedom in swiveling over base clamps; a hardened steel screw nut which is easily removable and a novel clean-out hole below the stationary jaw for quick removal of chips and waste from around the screw. The vise is made in three sizes, 7, 10 and 13 in.

Edmont Synthetic Gloves Resistant to Abrasives

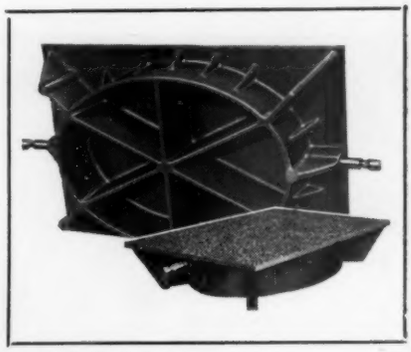
Synthetic "7" rubberized fabric gloves, announced by Edmont Mfg. Co., 553 Orange St., Coshocton, Ohio, are flexible and long wearing. They are liquid



proof and will not snag and are lined with a sturdy, napped canton flannel of top quality. These gloves are highly resistant to oils, greases, solvents, acids, caustics, corrosives and severe abrasives. They are available in knit-wrist style and gauntlet type in 10, 12½, 14½ and 18 in. over-all.

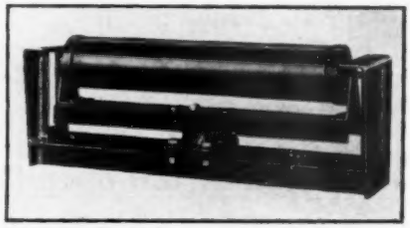
Smith Tool Surface Plates Designed for Constant Accuracy

Master surface plates made from a special fine grain cast steel of controlled hardness and designed to eliminate future distortion are offered by the Smith Tool Works, 822 N. Sandusky Ave., Bucyrus, Ohio. Severe working tests have demonstrated that these surface plates maintain a constant accuracy over a long period of time. A large elliptical rib reinforced with six-point spider rib and supporting ribs to outer edges give unusual stiffness and rigidity.



Chain Belt Rex Idlers Give Longer Conveyor Belt Life

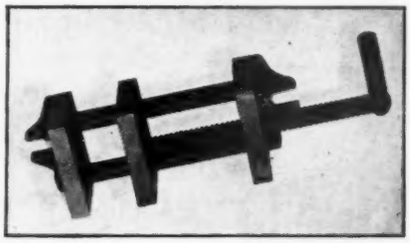
To help make conveyor belts last longer the Chain Belt Co., 1600 W. Bruce St., Milwaukee, Wis., has announced a self-aligning idler for flat conveyor belts. The same principle of construction as



the Rex self-aligning troughing idlers is used. No side guide rolls to impose unnecessary wear on the belt edge are used. Where excessive misalignment of a conveyor belt exists, caused by such factors as stretch or weave in the belt, uneven loading of material on the belt, or shifting of the conveyor frame, idlers spaced at intervals between the stationary idlers will automatically bring the belt back to the central position and avoid possible injury to the conveyor belt.

Steel Drill Press Vise Used For Small Assembly Work

A simple, inexpensive and practical all steel drill-press vise adapted to small assembly work and to hold small pieces



for machinery, filing, and so forth during bench operations has been introduced by Patterson-Ballagh Corp., 1900 E. 65th St., Los Angeles, Calif. In all three working positions it lies flat on the faceplate. Square thread operates against a bronze thrust bushing. Production is speeded up by the use of two guide bars which permit the operator to drill completely through the work without injury to the vise. The model shown in the illustration has a 5½ in. opening, with ears to fasten to the faceplate. The vise is also made with a 3 in. opening, without ears.

Air Reduction Tips Permit Close-Quarter Flame Cutting

Two additions to its line of oxyacetylene flame cutting tips have been introduced by Air Reduction Co., 60 E 52nd St., New York, N. Y. One is known as Style 108, ideal for working in close quarters. It is bent in an offset shape to permit cutting along a line 21/32-in. from the vertical center line of the torch head or barrel. This tip has milled flat sides with two preheat flames and is suitable for either machine or hand cutting operations. It is available in sizes Nos. 1 to 3, for cutting steel up to 1½ in. thick.

The Style 139 straight tip with one preheat orifice is particularly adapted to splitting angle iron, straight line cutting using a straight edge as a guide, or sheet metal cutting operations, in which light preheat is desired. This style tip is available in sizes Nos. 0 to 3.

General Electric A.C. Electrodes Will Operate in All Positions

An all-position a.c. electrode, Type W-26, to meet high-quality requirements has been announced by General Electric Co., Schenectady, N. Y. By the use of this electrode welding shops and fabricators, who have heretofore needed to supplement their a.c. welders with standby d.c. welders in the vertical and overhead positions, will be able to release these machines for work where d.c. welding may be essential. This type electrode is available in ⅛ in. and 5/32 in. diameters.

Set-Up Time Reduced on F&H Vise Built With Swivel Clamp

An "angle machining package," designed to materially reduce set-up time in the production of compound angles, has been introduced by the F & H Manufacturing Co., 6024 Ellery St., Detroit, Mich. The package consists of three parts—the F & H universal vise, with improved locking control, a grinding wheel angle dressing attachment, and a unique swivel clamp for holding odd shaped work pieces. The latter, called "Equi-hold," consists of two friction plates joined together by ball and

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OR COMPLETE SETS
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✓ SAVING TIME ✓ SAVING WORK
✓ FREEING MAN-POWER ✓ SAVING SPACE

In foundries, ammunition plants, steel and brass mills, aviation machine shops and in scores of other plants, Standard Conveyors are doing an important job—keeping high-speed production machines supplied—moving materials and parts "on schedule" from department to department—freeing manpower for effective work in the nation's "battle of production."

"CONVEYORIZE" TO MEET TODAY'S NEED FOR SPEED

The 76-page booklet, "Conveyors by Standard," will aid you to determine the best types of power and gravity conveyors to step up production in your plant—suggests how you can "conveyorize" to meet today's need for speed—keep production flowing—utilize every square foot of floor space effectively—save time, costs, and manpower in handling. Write for your copy of Bulletin AM-7, "Conveyors by Standard."

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POWER AND GRAVITY
Standard CONVEYORS
FIRST FOR FASTER PRODUCTION

socket. It fits between the work piece and one jaw of the vise, being fastened to the latter, adapting itself to the angle of the piece.

The vise is of all steel construction, precision built, with hardened and ground steel jaws. Vernier dials are standard equipment. The vise is only 4¾ in. high, jaws open to 2¼ in., weight is 14 lb.

The grinding wheel dressing attachment which fits into the vise eliminates the need for a separate angle wheel dresser. The dressing tool is rigidly held at the correct "drag" angle for best dressing results.

Owatonna Tool Builds Giant Sledging Wrench

For use in making repairs on pumps, turbines, generators, marine engines, diesels and other large machinery the Owatonna Tool Co., 353 Cedar St., Owatonna, Minn., has developed a giant sledging wrench of sturdy alloy steel. It is made to meet desired specifications.

NEW MATERIALS

Oakite Aviation Cleaner Removes Stains From Aluminum Parts

For cleaning aluminum and magnesium before and after heat-treatment Oakite Products, Inc., 24 Thames St., New York, N. Y., has introduced an aviation cleaner and compound No. 84-A. Removal of oil, dirt and fabricating greases from parts before heat-treating is accomplished by immersing them for required period in suitable tank charged with the aviation cleaner at a strength of 4 oz. per gal. of water.

Heat strains or discoloration on aluminum sheets and parts can be removed and the original finish of parts restored by immersing the work from two to fifteen minutes in a solution of compound No. 84-A, 8 oz. per gal. of water. The material and method employed for removing heat stains or discoloration are also suitable with variations for use in connection with such other operations as degreasing aluminum parts before anodizing; preparing aluminum alloy structures, assemblies and parts for resistance spot welding; removing anodizing film from rejected aluminum parts; and stripping anodizing coatings from racks, straps and similar equipment.

Stoody Hard-Facing Alloys Made For Low Priority Users

To serve companies unable to furnish high priority ratings, the Stoody Co., Whittier, Calif., has developed two hard-facing alloys marketed under the names Stoodite K and stoody self-hardening K. Stoodite K is a cast hard-facing rod consisting principally of

molybdenum, tungsten, manganese, silicon, carbon and iron. It is supplied in bare form for oxyacetylene application, and in coated form for d.c. electric application, in rod lengths of 14 in. and rod sizes ⅛, 3/16, ¼, 5/16 and ⅜ in.

Stoody self-hardening K is made in the form of tubes and is composed principally of molybdenum, manganese, silicon, carbon, vanadium and iron. This rod is furnished bare for oxyacetylene application and bare and coated for d.c. electric application, in acetylene rod length of 28 in. or electric rods 14 in. in length, and rod sizes ⅛, 3/16 and ¼ in. Specifications of these rods may be obtained from Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.

American Steel Wool Makes Spindle From Type A Ribbon

A spindle made from the Type A ribbon steel wool has been produced by American Steel Wool Mfg. Co., Inc., 42-24 Orchard St., Long Island City, N. Y. This spindle is made by wrapping the steel wool around a small shaft and then mounting the completed shaft or spindle in a chuck. In one operation it is possible to clear burrs from three sides and two edges. When the spindle is in use it does not make any permanent grooves. After the spindle is worn down it is only necessary to add an additional length of ribbon steel wool on that remaining on the spindle.

TRADE PUBLICATIONS

AIR CONDITIONERS Bulletin G-2, issued by the Air and Refrigeration Corp., 475 Fifth Ave., New York, N. Y., describes the capillary cell and its application in air-conditioning equipment as a direct heat transfer surface between water and air and outlines the functions of the cells for cooling and dehumidifying, humidifying, air cleaning, evaporative cooling, condenser water cooling and fume absorption.

CARBIDE TOOLS Bulletin No. 142, offered by Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich., describes standard tools and blanks, torpedo type wheel dressers and carbide tool grinder.

CASTINGS A booklet published by the Hammond Brass Works, Hammond, Ind., entitled "Practical Data on Brass and Bronze Castings" is a handy, compact reference work of standard specifications, applications and other related information.

MANPOWER "The Coming Crisis in Manpower" is the title of a 32-page pamphlet just published by the Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York, N. Y. The pamphlet

Saw-way MULTI-PURPOSE INTERNAL GRINDER

Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

Offers greater flexibility . . . a precision grinder, designed and built by engineers with years of practical experience to guide them . . . has a headstock traverse of 6″ . . . grinds holes ¼″ to 18″ in diameter . . . holes up to 9″ deep, straight or tapered . . . entire headstock may be moved at right angle to wheel traverse, by merely loosening two conveniently located nuts . . . worm compensating device permits grinding wheel head adjustment to .0001 . . . sturdy construction throughout . . . full specifications, delivery time and price on request.

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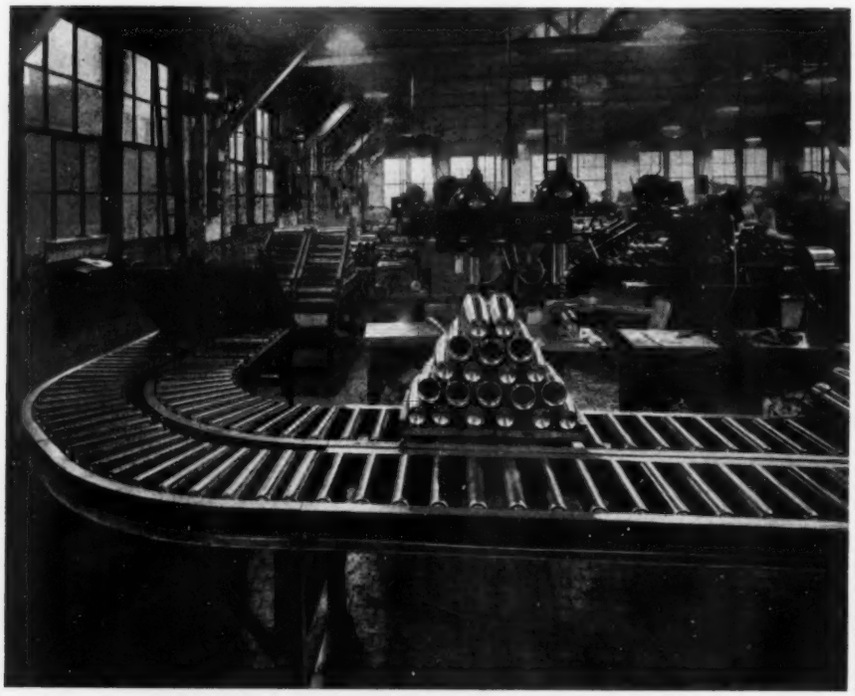

DOUBLED CAPACITY FOR WAR PRODUCTION

Stepping up our productive capacity month after month has barely enabled us to keep pace with mounting war orders. As long as this condition exists, it becomes increasingly difficult to meet civilian requirements. Our one big job is the handling of war material. That job must come first.

places first among the issues which the War Manpower Commission must face, the basic problem of balancing our military and naval needs against our industrial requirements in light of our lend-lease commitments. Price, 10 cents per copy.

MATERIALS HANDLING "Cleveland Crane Graphic" is the title of a bulletin on materials handling equipment published by the Cleveland Crane & Engineering Co., 1129 East 283rd St., Wickliffe, Ohio.

METALLIZING A 16-page bulletin, 42A, published by Metallizing Engineering Co., Inc., Long Island City, N. Y., describes the metallizing process and equipment for its application.

MORALE A manual for business executives and plant managers on "How to Boost Production Through Increased Employee Morale" is available from Industrial Division, Labor Relations Institute, 1775 Broadway, New York, N. Y.

PRECISION DRESSING The Diamond Tool Co., 938 E. 41st St., Chicago, Ill., offers grinders instruction cards giving important information on precision dressing.

PRESSURE INSTRUMENTS The 23-page, illustrated catalog No. 76JF, published by Taylor Instrument Companies, Rochester, N. Y., describes the bourdon spring, bellows and manometer type instruments for indicating, recording and controlling pressures.

PROGRESS The 53-page illustrated book issued by Air Reduction Co., Inc., 60 East 42nd St., New York, N. Y., is entitled "A Quarter Century of Progress."

PUMPS Bulletin No. 301, "Facts About Rotary Pumps," explaining the operating principle of swinging vane type rotary pumps is obtainable from Blackmer Pump Co., Grand Rapids, Mich.

RECTIFIERS Bulletin No. 61, prepared by Electro-Matic Products Co., 2235-37 North Knox Ave., Chicago, Ill., illustrates and describes rectifiers featuring the new time delay switch.

RHEOSTATS A 16-page catalog, No. 18, listing over a thousand stock items in rheostats, resistors, tap switches, chokes and attenuators is offered by Ohmite Mfg. Co., 4835 West Flournoy St., Chicago, Ill.

RUBBER A 48-page illustrated book on conservation of rubber products in industry, entitled "First Aid to Industry in Conserving Rubber," is offered by United States Rubber Co., Rockefeller Center, New York, N. Y.

SALT BATH FURNACE Various types of internally heated salt bath furnaces and pots, including those required for

hardening of "Moly" and high speed steels, are discussed in a four-page folder entitled "Where Should Heat Treating Heat Go?" issued by Upton Electric Furnace Division, 7450 Melville Ave., Detroit, Mich.

SHEET METAL Manufacturers, who must of necessity subcontract certain sheet metal parts and assemblies will find a list of machines for prompt execution of sheet metal, sheet steel, and light plate fabrication given in "Data on Production Facilities" offered by The Kirk & Blum Mfg. Co., Spring Grove Ave., Cincinnati, Ohio.

SPEED CONTROL "More Output for Defense" is the title of a 20-page book prepared by Reeves Pulley Co., Columbus, Ind., describing and illustrating examples of how variable speed control is being used to speed up defense production.

SPRINGS "Instrument Springs" is a 12-page illustrated booklet published by All-Weather Springs, 72 Washington St., New York, N. Y.

NEW BOOKS

MAGNETIC TOOLS AND APPLIANCES—*By E. Molloy. 116 pages. Published by The Chemical Publishing Company, Inc., 234 King St., Brooklyn, N. Y.* $2.50.

This volume on the industrial applications of magnetic devices deals principally with British practice, all of the illustrations showing British-made units. Nevertheless, similar magnetic units are available in this country and the practices discussed are in line with methods employed here.

Among the magnetic tools and appliances described are chucks, clutches, lifting magnets, brakes, and separators, as well as equipment designed for detecting flaws in parts made of magnetic materials. Each of these applications is discussed in detail.

•

LESSONS IN PRACTICAL ARC WELDING—*By W. J. Chaffee. 188 pages. Published by Hobart Trade School, Inc., Troy, Ohio.* $0.75.

This book comprises the second part of the five-part Hobart handbook "Practical Arc Welding" and contains the complete series of 41 arc welding lessons offered at the Hobart Trade School. Chapter headings include: Preliminary Instructions, Starting and Manipulating the Arc, Welding Common Joints with Bare Electrodes, Welding Light Gage Sheets with Coated Electrodes, General Welding with Coated Electrodes in the Flat, Horizontal, Vertical and Overhead Positions, Pipe Welding, Welding Cast Iron, and Special Practice and Tests.

The text material, following the in-

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These modern saws are cutting millions of feet of sheet, bar and block metals—steel tubing—the tough new alloys and plastics used in today's planes, jeeps, rifles, etc.

Forty-two different tempers, pitches and sizes have been perfected to date, with extra-hardened teeth to take care of every sawing job faster and better.

Above view shows how operator saws with the aid of a magnifying attachment for great precision in slotting brass brush holders at Marion Steam Shovel Company.

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DO ALL SAWS

troduction and preliminary instructions, is divided into welding exercises of gradually increasing difficulty. The student is taken through the various problems involved in practical arc welding as rapidly as he can master the principles involved. In the appendix are given the tentative standard methods for mechanical testing of welds, as prepared by the Committee on Standard Tests for Welds of the American Welding Society.

•

FOUNDRY WORK—*By R. E. Wendt.* 261 *pages. Published by McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y.* $2.

Here is a book for teaching foundry practice in schools and colleges, as well as for use by apprentices in commercial shops. Although it is elementary to the extent that students can grasp the fundamental principles of foundry work, it is deep enough to give a general working knowledge of foundry practice.

This fourth edition is offered in seven parts: (1) Different groups of cast metals, tools, flasks, molding bands, and fundamental principles of molding. (2) Exercise in bench and floor molding. (3) Pattern equipment, standard pattern colors, designing castings, molding machinery and molding brushes to be used in mass-production foundries. (4) Dry sand core making and core-making exercises. (5) Cupola practice, mixing of metals, cleaning and grinding of castings. (6) Non-ferrous metal founding. (7) Problems of foundry management, cause and prevention of defects in castings, and safety measures in foundries. Also included is a glossary of foundry terms, special tables and a list of foundry books for general readers.

•

AIRCRAFT ENGINE DESIGN—*By Joseph Lifton. 486 pages. Published by McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y.* $4.50.

This book was prepared to aid technical students in bridging the gap between (*a*) where they have a fairly complete knowledge of the fundamentals of mathematics, mechanics and machine design, and (*b*) the point where they are sufficiently familiar with the application of these fundamentals to the design of aircraft engines. The author has included an outline of procedure for designing engines, which covers considerable accumulation of data.

The procedure outline and rational data for engine design were included because students entering this field of study are usually lacking in the experience necessary to decide on a logical procedure of engine design. This material also helps the student who lacks accumulated information upon which experienced designers can call

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and Gears run
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"STURACO"
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Results from this unusual principle of lubrication have been astonishing. What is your tough problem?

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when making the innumerable assumptions that must precede or parallel the analysis of various engine parts.

The book is complete with engineering design data, including those for gas-pressure forces, and analysis of loads on various engine parts. Aside from stipulating design procedure for the engine parts, the author includes data on engine vibration and balance, and information on all aircraft engine accessories.

•

METALLURGY—*By Carl G. Johnson, assistant professor of mechanical engineering, Worcester Polytechnic Institute. Second edition. 262 pages. Published by the American Technical Society, Drexel Ave. and 58th St., Chicago, Ill.* $2.50.

Because of the growing importance of the subject in industry today and the ever increasing number of individuals concerned with it, the author has revised his book with an eye to improving the original presentation, adding new important material, and providing the average reader who has but little time for study with a practical working knowledge of the manufacture and behavior of metals and their alloys.

Fully illustrated, the 262 pages of this book contain a wealth of information on such subjects as bearing alloys, aluminum alloys, copper and copper alloys, alloy steels and cast iron, heat treatments and many others. Quiz questions appear at the end of each chapter to facilitate review and study.

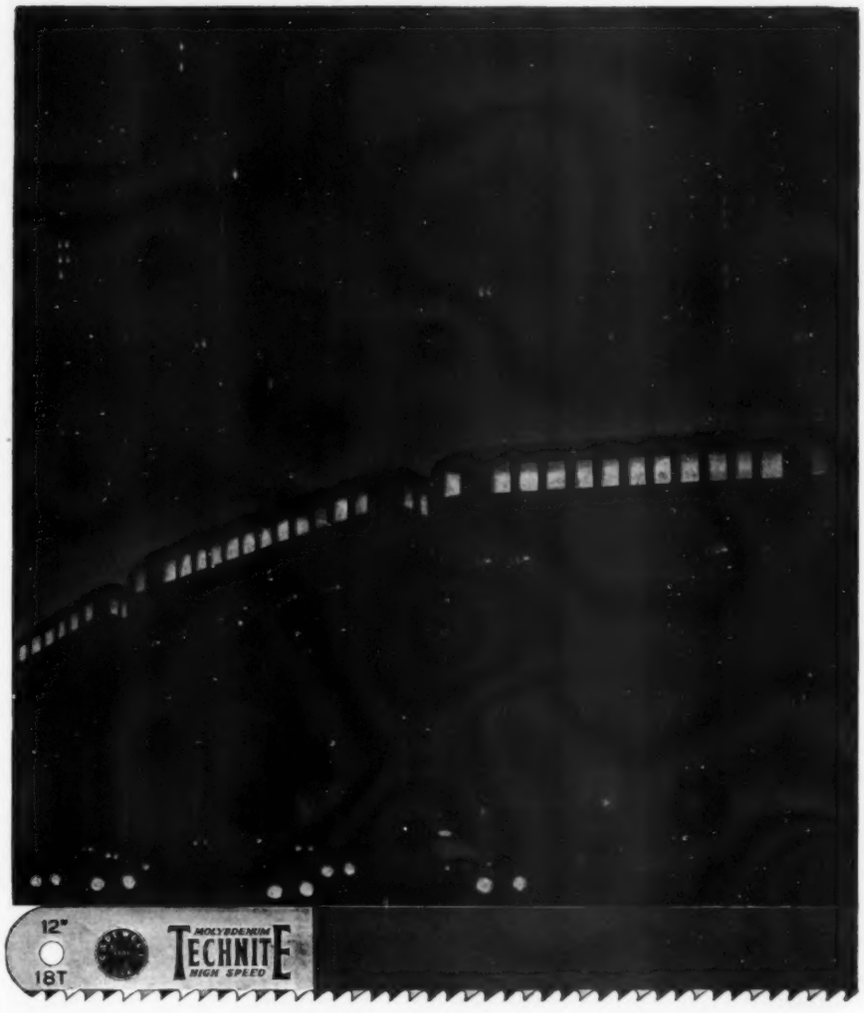
•

HANDBOOK OF MECHANICAL DESIGN—*By George F. Nordenholt, Editor, Joseph Kerr, Managing Editor, and John Sasso, Associate Editor of Product Engineering. 277 pages. Published by McGraw-Hill Book Company, Inc., 330 W. 42 St., New York, N. Y.* $4.00.

This new handbook, edited to serve as both useful reference and design guide, features practical methods and procedures now in use in progressive engineering departments. It is presented in a way most convenient to the mechanical engineer seeking ideas and information on materials, fabricating methods, mechanical details and constructions.

The data is presented in the form of engineering sketches, charts, tables, formulas and nomographs grouped according to basic design problems. It includes 36 consecutive pages of tables comparing properties, compositions and applications of all the commonly used engineering materials; 23 pages of sketches showing typical latches, locks and fastenings; and 34 pages of sketches showing details of power transmission elements and mechanisms. Practically no explanations of theory are included. Large-size pages place a maximum of information before the engineer at one glance.

The book which has no parallel



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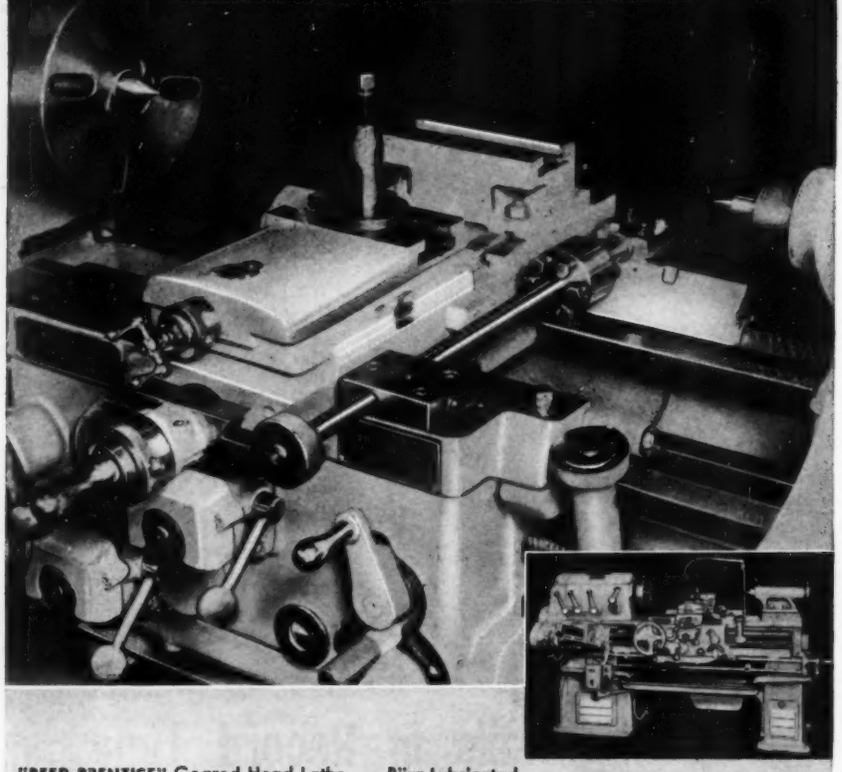

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among existing handbooks, was prepared by members of the *Product Engineering* staff. The form of design data is similar to the Reference Book Sheets and mechanisms pages published regularly in the magazine. Much of the material is new but some has appeared in past numbers of *Product Engineering*. However the previously published material has been condensed, rearranged and brought up-to-date. Subjects covered in the eight chapters include: charts and tables for general arithmetical calculations; materials; beams and structures; latches, locks and fastenings; springs; power transmission elements and mechanisms; drives and controls; and design data on production.

•

OIL BURNER HANDBOOK—*By L. J. Whelan, oil burner instructor, New York Technical Institute. 245 pages. Published by the Master Plumber & Heating Contractor Magazine, 554 Atlantic Ave., Brooklyn, N. Y.* $2.50.

Data on the installation and servicing of domestic and industrial oil burners is incorporated in this handbook on oil burner operation. Developed especially for the oil burner service man, this handbook deals principally with the problems he meets in the field. It is of particular interest at the present time since it contains a number of suggestions on the proper servicing of oil burners which should increase their life. The several chapters in the handbook discuss the design and construction of boilers, oil burners, storage tanks and controls. Drawings are used throughout the text to illustrate the units being discussed.

•

PLANE TRIGONOMETRY MADE PLAIN—*By Albert B. Carson, instructor of mathematics, Louisiana State University. 389 pages. Published by The American Technical Society, Drexel Ave. at 58th St., Chicago, Ill.* $2.75.

In this text the essentials of plane trigonometry are discussed in considerable detail, much attention being devoted to numerical work. Emphasis is placed on the application of trigonometric principles in the solution of everyday problems. The author has provided a large number of figures and illustrative examples which are designed to help the student further visualize the how and why of trigonometry. In addition, a number of typical problems are given to show the student the practical uses of trigonometry in its own field, as well as a stepping stone to higher mathematics.

Logarithms are introduced early to facilitate calculations and prepare the student for more advanced principles where logarithmic treatment is necessary. The book contains tables of logarithms of numbers, natural trigonometric functions and logarithms of trigonometrical functions.

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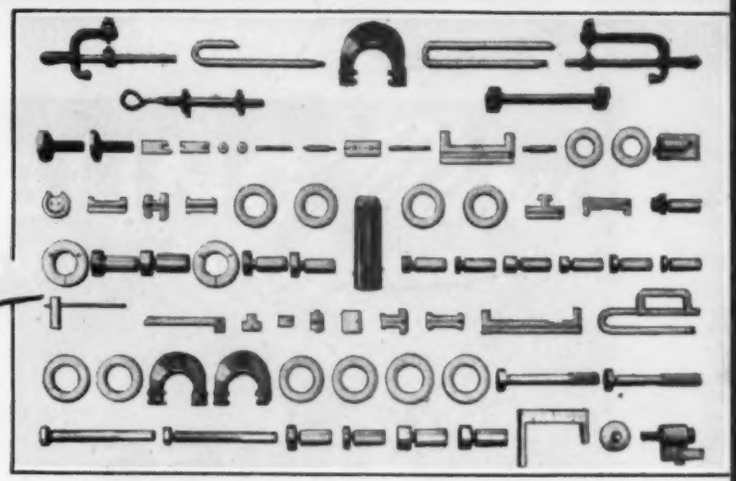
Checking each dimension separately and laboriously with its own fixed size gage requires many inspectors and lots of time. This set of gages was used in checking the critical dimensions of a 75 mm. shrapnel body.



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The Foreman Personalizes Management

By D. D. DECKER
Personnel Manager
Wolverine Tube Company

The changeover from peace-time to war production presents the foreman with a challenge and an opportunity to interpret management to the new men, and to old men on new duties, in such a way as definitely to improve morale in his department. The foreman must recognize that old employees, as well as new employees, require time to learn the new job. Tact, diplomacy and understanding are needed in abundant quantities to break in such employees on their new jobs, to teach them new skills, to correct their mistakes, and to iron out the rough spots in their work.

Taking ample time to break in and train such employees will well repay the foreman, by the lack of headaches later on. Even after they are broken in and trained, the same thing applies to the taking of sufficient time to keep the men informed of the nature of the work which lies ahead, and to the efforts expended to secure their teamwork in whipping new jobs.

One of the easiest and best ways of doing this is to keep the men constantly informed of the reasons for, and the necessity of, quickly developing maximum output. Letting the men know enough about their jobs so that they know something about the product—why it is made, what it is used for, and whenever possible, where it is going—these things will give them a new interest in their jobs, and they will know their foreman takes a personal interest in them. This feeling on the part of the men will go far in licking production problems. Real efficiency can be secured in a way which encourages cooperation rather than antagonism. By showing a concern for their health, safety and personal welfare, much can be accomplished. As an example, the foreman should sell his employees on the reasons why prompt reporting and treating of minor accidents is important. He must not let his employees get the feeling that they will be criticized for the reporting of minor accidents. In other ways he can also personalize management.

The foreman must be fair, impartial, and must keep his promises. He must try to win the confidence of his men, and once this has been accomplished, keep that confidence by not betraying it. He must remove every possible source of job irritation. Doing this, and at the same time increasing his departmental efficiency, can be accomplished by arranging the department to avoid unnecessary and wasteful motions, seeing that materials and supplies are available when needed; seeing that tools and equipment are in good condition; and seeing that the work-place has good light, heat and ventilation.

Using Manpower Effectively

The winning of this war is even more the responsibility of men in industry than it is of our soldiers and sailors and marines. It is betraying no military secret to say that, by present forecasts, the calendar year 1942 will require an increase of 2,200,000 persons in the armed forces and 10,700,000 among civilian employees of the war industries. That is a shift in occupations of nearly 13,000,000 people and a probable shift in geographic location of most of them.

At the present time we continue to have what is called a free labor market. Under this system, which is the normal situation in peacetime, every employer is permitted to follow his own devices in recruiting labor. Every worker is free in his choice of a job. Controls are beginning to be exercised, but it is obvious that the 1942 war production program cannot be manned by this voluntary basis of employment. We are obliged to organize the labor market and exercise direction of its processes if we are to secure the 10,700,000 new persons for civilian employment.

The most practical way to obtain the skill necessary for the war program with the existing supply of skilled workers is, of course, to utilize existing craftsmen at their best skill and upgrade other workers to take over that part of their normal work requiring lesser skill. Frequently toolmakers and similar craftsmen are utilized as supervisors and instructors, and multiply themselves as craftsmen in the training of machine hands in one part after another of carefully broken-down jobs.

Another way to utilize craftsmen at their best skill is to keep them on that best skill all of their time, instead of doing what is so frequently regular practice—that of working a toolmaker part of his time as a machine hand. To overcome this, the toolmaker may have to be a more mobile sort of worker than he is now—his job may need to be recast as that of a one-man flying squadron serving several departments or even plants for that portion of their time that they actually *need* a skilled toolmaker.

The only way the totalitarian state powers of our Axis enemies can be licked by democratic nations is by labor's voluntary acceptance of controls that must necessarily approach, if not actually encompass those of a dictator.

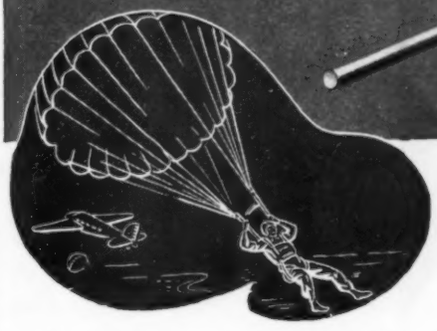
It is one thing to have the dictator of a totalitarian state mobilize and dominate civilian effort into virtual serfdom by force—it is quite another thing to have government agencies voluntarily set up, organized and staffed by citizens who willingly subordinate themselves to a centralized control in order that their united efforts may be coordinated into uniform and unified effort. And it is just that difference that will result in final victory.

Abstracted from a talk presented at a conference on "Manning and Managing our Arsenal" by Arthur H. Young, lecturer on industrial relations, California Institute of Technology.

ROEBLING *Wires*

ROUND . . . FLAT . . . SHAPED

A FEW WIRES TYPICAL OF ROEBLING'S BROAD SPECIALTY PRODUCTION
FOR VICTORY ASSIGNMENTS
WHERE WIRE MUST BE RIGHT!
SHAPED WIRES
FLAT WIRE TO SPECIFICATIONS
MUSIC WIRE FOR PARACHUTE PILOT-CHUTES



The springy frame for the small pilot-chute that pulls the Army parachute from the pack *must be right.* The Roebling wire used for this service meets exceptionally high standards for steel analysis, temper and fatigue resistance.

The speed and quality required by war production again prove the wisdom of turning to Roebling for special round, flat or shaped wires. If you have a tough job, avail yourself of Roebling's long experience in the production of high grade wire. Every day we're turning out wire to specifications demanding the finest craftsmanship and close adherence to physical and chemical requirements.

Special facilities to handle this type of work . . . Man-power to give it the close attention to details it requires . . . these are Roebling's contribution to your Victory program.

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IMAGINEERING

SO MUCH SO SOON

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We are busy making more millions of pounds a month than we made in a whole year, not so long ago—but not too busy to make sure that no single pound of aluminum at work anywhere on war effort shall fail to do its share of making whatever it takes to win.

SECOND OFFER: If you are making anything whatsoever out of aluminum, and are stumped in any way in setting up the best methods of fabricating it—give us the facts, and we will see that you get all the know-how in our power.

THIRD OFFER: If you have joined the host of those who believe that industry must even now be planning the new products that will make jobs when this thing is finally over; if you are letting your imagination soar: Won't you ask us to help you engineer it down to earth with all the up-to-date facts about Alcoa Aluminum, plus some of the very practical dreams we have been dreaming?

AND THE PROPOSAL: Do some personal Imagineering, right now, for the sake of your own personal tomorrow.

We have been talking Imagineering for some months largely in terms of the future. And in terms of industry. But here is the personal slant:

Thirty billion dollars is loose in the country. It is the gap between what is available for spending and what is available for personal purchases. Each of us has a sliver of that chunk of excess purchasing power.

If we put it into War Bonds, we are told that it will both finance the war, and avoid inflation. We sometimes forget that it will also finance ourselves, as users of goods, to buy the new products we are all readying, as makers of goods. Buying tomorrow, today, is patriotism and sense—business sense.

Aluminum Company of America, 2107 Gulf Bldg., Pittsburgh, Pa.

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are helping many plants secure increased production, longer tool life, and better finishes

This automatic screw machine operator reports that Gulf Electro Cutting Oil helps him produce more parts per hour, with better finishes and fewer rejects—a typical record of performance with this quality Gulf product.

Put these quality cutting oils to work in your plant . . . to help improve your machining practice.

ENGINEERED to meet the production requirements of *today*, improved Gulf cutting oils are helping set new standards of machine tool performance in many plants!

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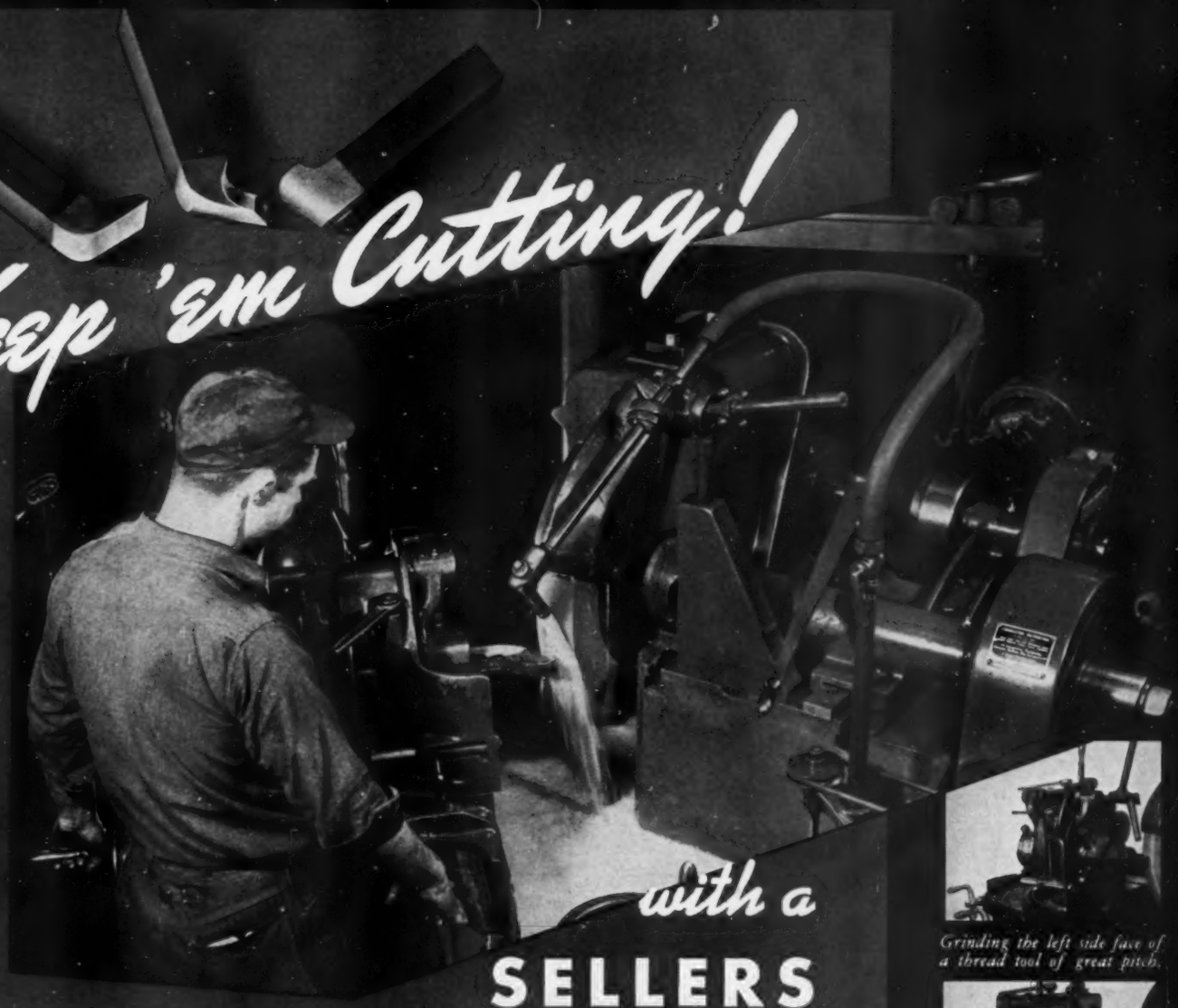

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Sellers No. 5T and 6T Tool Grinder grinds any cemented carbide or high speed steel, straight or convex curved face tools, including thread tools of any angle of thread or pitch, internal or external, and will accurately reproduce the desired angles and clearances on all the tools. It handles all sizes of tools and tool bits from ¼" up to the maximum size of the chuck used, 2" x 2½" or 3" x 3" square.

This machine does all the work necessary to finish to shape from either forged or bar stock cutting tools for lathes, planers, boring mills, etc., making it possible to maintain, ready for use, a full supply of such tools. It effects savings in tools by removing the minimum amount of tool material, in production costs by producing the exact shapes required to maintain high cutting speeds, and in grinding time, by more rapid shaping and sharpening.

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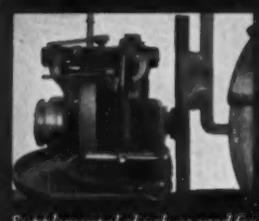
Grinding the left side face of a thread tool of great pitch.

Grinding the left side face of a large V-tool.

Grinding a circular tool.



Supplemental chuck as used for the end face of a hook tool.

Setting a curved face tool by this index.

Better filing with THE RIGHT FILE FOR THE JOB

• There's a fast and a slow—an efficient and an inefficient—way of doing everything. This is particularly true of filing.

• Nicholson Special Purpose Files are designed to speed filing work —produce better results—reduce rejects and wasted effort.

• "Speed it up!" is the industrial war cry. Take die castings. You *can* do a fair finishing job with an ordinary file. But you can do it heaps faster and more accurately with *The right file for the job.*

• Nicholson or Black Diamond special files for finishing die castings of aluminum-alloy and similar metals are made with extra-strong teeth on sides, edges and corners—to resist shelling off and breaking out. The design eliminates to a great extent the tendency of these metals to clog the file. Regularly made in Mill Bastard and Half Round Smooth. . . . And *Twelve perfect files in every dozen* are guaranteed! Obtainable through your mill-supply house.

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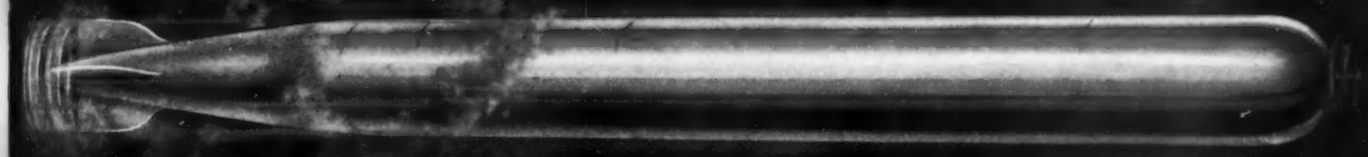

. . . remarkable new cutting oils bring answers to new problems

● IN the switchover to war production, industry has faced problem after problem. Many of them have been solved—frequently with the help of Standard Oil Engineers. Here are some typical examples. They may point the way to you. They may show how you, too, can find the solution to problems existing in your plant.

JOB—Machining coupling for hydraulic assembly for raising and lowering landing gear.

PROBLEM—Eliminating rough finish and rapid tool wear on tough aluminum alloy parts.

RESULT—Developed special cutting oil which gave maximum tool life and satisfactory finish with the elimination of odor development.

JOB—Form grinding steel alloy gears for adjustable blade propeller assembly.

PROBLEM—Increased stock removal to speed production.

RESULT—Developed mineral oil with special compounding to eliminate burning of work at high wheel speeds and feeds, and reduce atomization or oil fog at high speeds.

JOB—Manufacture of shell forgings.

PROBLEM—Improve interior finish of shell and increase piercing-tool life.

RESULT—Special forging oil produced to carry solids in suspension in the oil to reduce abrasion and rapid deterioration of the piercing tool and at the same time eliminate separation of solids from oil in storage. This special oil reduced carburizing of the tool, facilitated removal from the shell forging at each operation, and improved accuracy and finish of shell interior.

If your problem is entirely new, you can still profit by the Engineer's experience and the complete technical and research facilities of Standard Oil on which he can call for help. You'll save your time at the start, and the product he recommends will save tool life and machine time on the job.

This service is available to all manufacturers in the Middle West. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago, Ill.

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WHAT TO LOOK FOR IN A HYDRAULIC OIL—AND WHAT YOU GET IN STANOIL

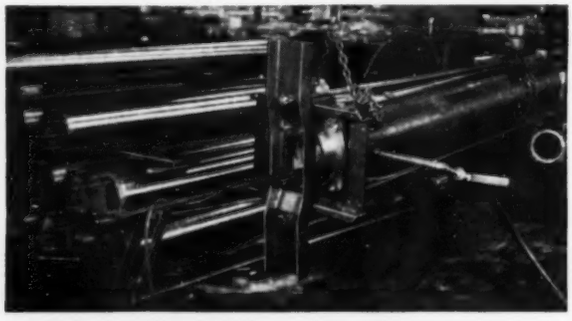
Do you find some of your hydraulic-operated machines inaccurate, sluggish, or noisy? These are a few good reasons for examining the oil you are using. When you've checked for possible mechanical defects in oil lines and pumps, then answer these questions.

1. Is the oil of right viscosity? Oil that becomes too light at high temperatures will not give full pressure. Oil that becomes too heavy at reduced temperatures causes sluggish operation and loss of power. Stanoil has a high *viscosity index*. Each grade operates over a wide range of temperatures without excessive change in viscosity.

2. Is the oil stable? Continuous circulation where even a small amount of air is present causes some oils to oxidize and form deposits in oil lines, valves, and pumps. Stanoil resists oxidation even under severe conditions found in partly filled gear cases.

3. Is the oil easily emulsified? Even a small amount of water causes some oils to form a frothy mixture. This reduces pressures and accuracy of operation. Stanoil is easily separated from water which may accidentally enter the hydraulic system through leaks or condensation.

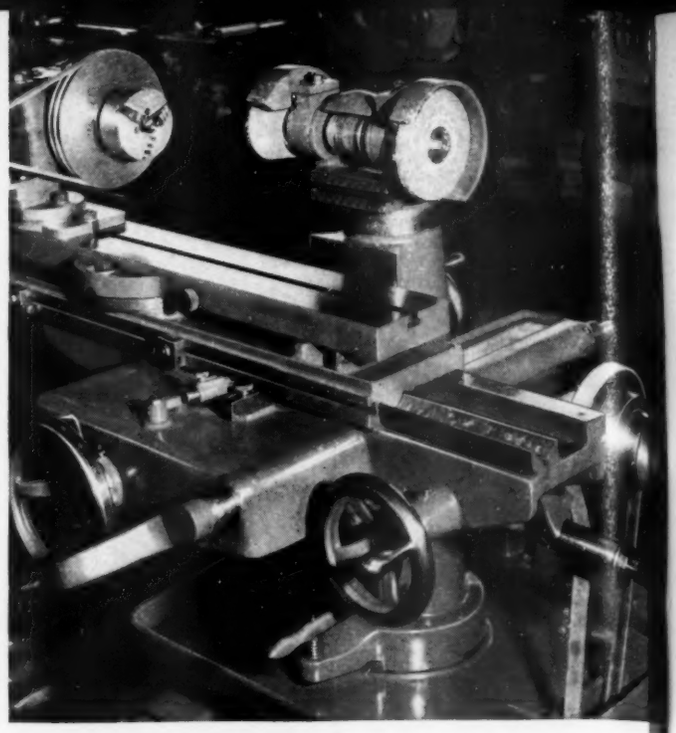
Let a Standard Lubrication Engineer recommend the grade of Stanoil you need on one machine. Compare the smooth, trouble-free operation it gives. You'll want that kind of operation on every hydraulic unit you have.



STANORUST STOPS RUSTING OF GROUND STEEL TUBING

Has the handling and shipping of new materials and parts brought new rusting problems? A Lubrication Engineer's experience can help solve your problem in a hurry.

For example, The Weaver Mfg. Co., Springfield, Illinois, manufacturer of twin post auto lifts, was testing the hydraulic cylinders with a conventional hydraulic oil. Although a film of oil was left on the cylinders, it did not protect the finely ground surfaces against rusting in storage. A Standard Oil Engineer recommended testing Stanorust as a rust preventive. No additional operations were required and no rusting occurred with Stanorust.



STANOLEX OIL 4 WAYS BETTER FOR LUBRICATING WAYS

Lubrication of machine ways and guides is a small detail in maintenance, but it can be an important factor in machine production. To do this job better, Standard Oil has developed a special line of oils.

When ways and guides tend to chatter or stick where straight mineral oils are used, the specially compounded Stanolex oils will give one or more of these advantages:

- **Finer Finishes** without the need for an additional grinding operation to remove tool marks.
- **Greater Accuracy,** particularly on hand-fed operations where sticking ways handicap the operator.
- **Less Operator Strain** where wheels or tools must be fed to the work by hand.
- **Longer Machine Life,** not only in the ways and guides, but in gears and feed mechanisms on tables and tools or wheels.

Let a Standard Oil Engineer test Stanolex Oil on just one machine in your plant. Let the machine operator tell you how much difference it makes.

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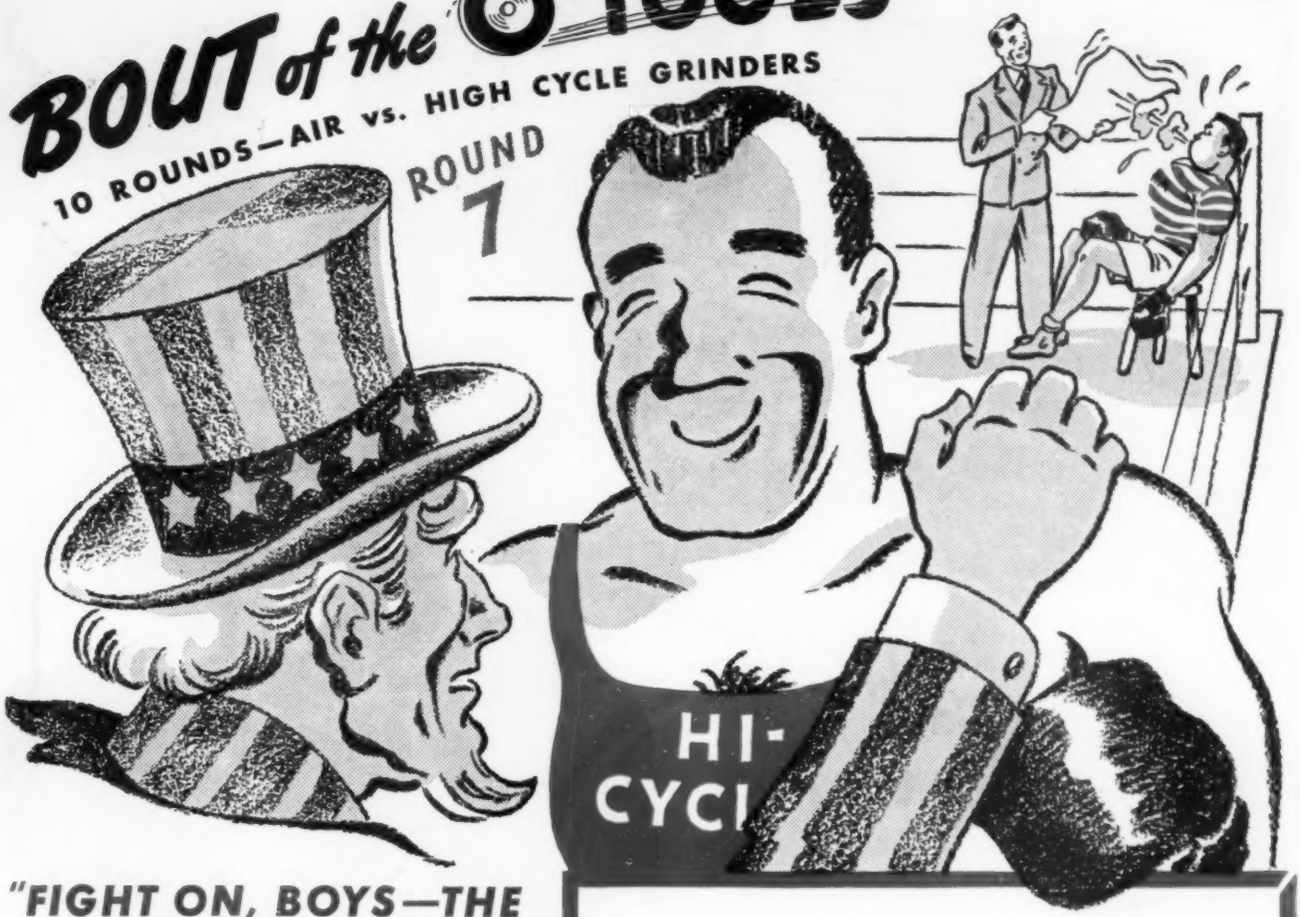
BOUT of the O'TOOLS

10 ROUNDS—AIR vs. HIGH CYCLE GRINDERS

ROUND 7



"FIGHT ON, BOYS—THE HARDER YOU SLUG, THE SOONER I WIN!"

Uncle Sam likes this Bout of the O'Tools because he knows that AIR and HIGH-CYCLE are fighting to *prove* which type of portable tool will turn out the MOST PRODUCTION under given conditions in various war plants. He says, "Slug away, boys. Every time one of you wins, a portable tool situation is well taken care of. That helps me win."

The decision for Round 7 goes to HIGH-CYCLE because on this particular job he kicked up sparks faster and at less cost than AIR. Read his War Winner's Report.

Call in the Rotor Analyst for unbiased suggestions on the selection and servicing of portable tools.

WAR WINNER'S REPORT TO: *Uncle Sam*

Here is my contribution to the war effort of a steel mill:

(1) Saved 66% in first cost of power unit.

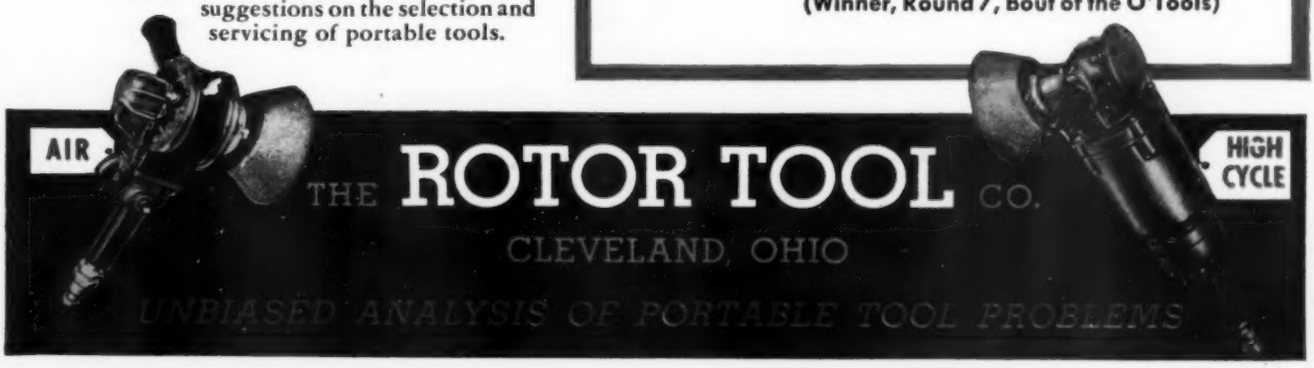
(2) Boosted production 30%.

(3) Saved 75% in electric power.

(4) Cut maintenance cost 20%.

(5) Lengthened life of grinding wheels 10%.

HIGH CYCLE O'TOOL
(Winner, Round 7, Bout of the O'Tools)



then I said to myself—

...and look at the saving in man-hours and materials

Sure, design for cost-saving is always important... but right now design for saving man-hours and materials is vital.

ALTER EGO: Isn't that just what the designers of this trailer chassis did? By changing over to welded design, they've saved 20% in man-hours and 25% in weight of iron and steel, in addition to costs such as shown.

Yes, but how about the man-hours required to change over designs and to convert production to welding?

ALTER EGO: It's simple and quick. Designs can be changed gradually, one part at a time. Production fixtures for the welded parts can be built easily and quickly.

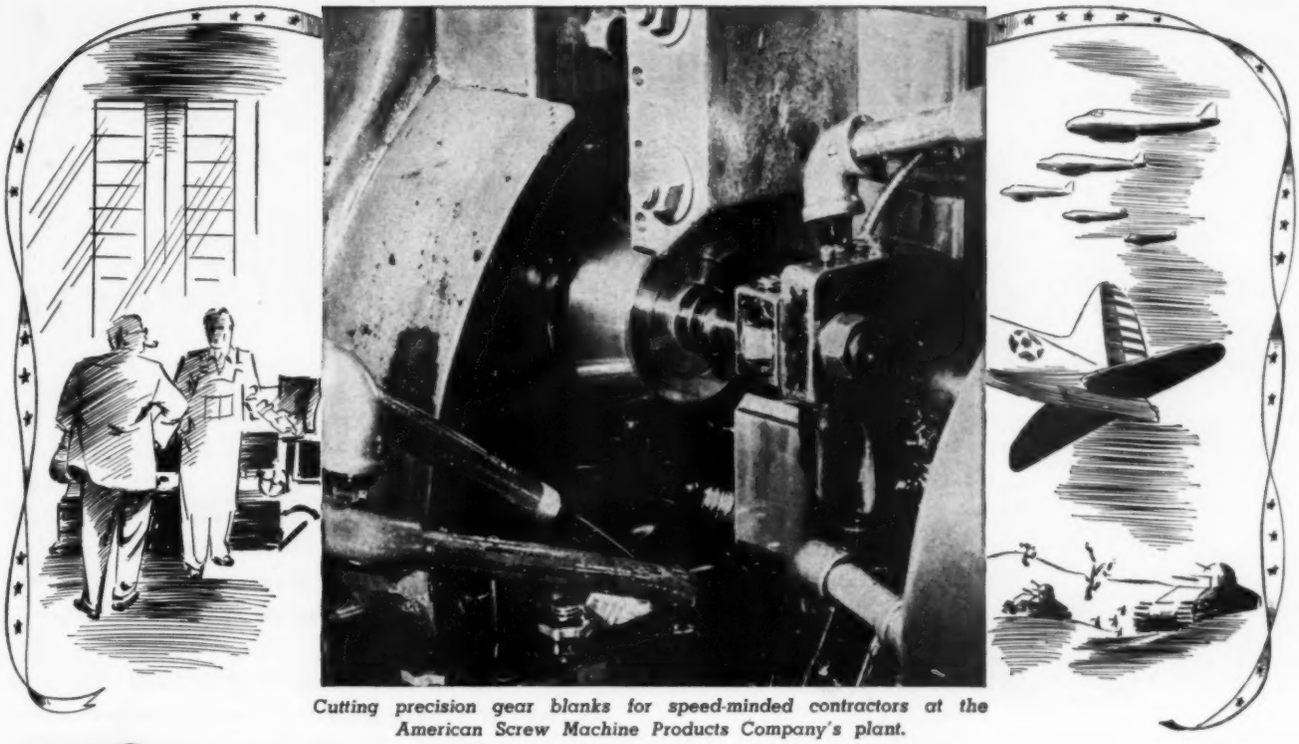
Then, doesn't that account for the industry-wide swing to welding? Everybody sees in this process a means of getting into production quicker and producing faster... to win the war.

ALTER EGO: Not only to win this war but to survive in the Battle for Business after this war. Why shouldn't we start by studying the Lincoln Handbook of Design and Practice and applying some of its suggestions? Everyone says it's the authentic reference guide on arc welding.

"Procedure Handbook of Arc Welding Design and Practice." 1120 pages. 1557 illustrations. Price $1.50 postpaid in U.S.; $2.00 elsewhere.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.



Cutting precision gear blanks for speed-minded contractors at the American Screw Machine Products Company's plant.

"Slick-" CONTRACTOR PRAISES CITIES SERVICE CUTTING OILS

Producing for America's armament is the immediate task of American Screw Machine Products Company.

It is one of the many shops specializing in subcontract work where accuracy, finish and speed are paramount. Says Lester E. Hoffman, Production Superintendent: "We've been under terrific pressure, working day and night to meet the schedule demanded of us by the armament program, and we always use Cities Service Cutting Oils because we know they turn out a *slick* job. For the past three years we haven't had a drop of oil in the plant that wasn't Cities Service."

You, too, will find that Cities Service Cutting Oils not only will do a "slick" job for you but an economical one as well. Let us prove this to you the practical way—by a test in your own plant under actual service conditions. An informative booklet "Metal Cutting Lubrication" is available to the personnel of cutting oil users. Fill out the coupon below and mail for your copy.

OIL IS AMMUNITION — USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.

or any of the following offices:
CHICAGO . CLEVELAND . ST. PAUL
KANSAS CITY . BOSTON . TORONTO
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ARKANSAS FUEL OIL COMPANY
SHREVEPORT . ATLANTA . BIRMINGHAM

Please send me information concerning your Engineers' Lubrication Service. ☐

Please send me your booklet, "Metal Cutting Lubrication." ☐ A.M.

Name_____

Firm Name_____

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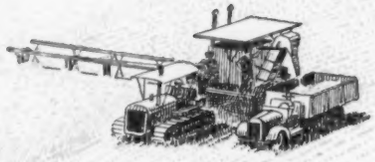
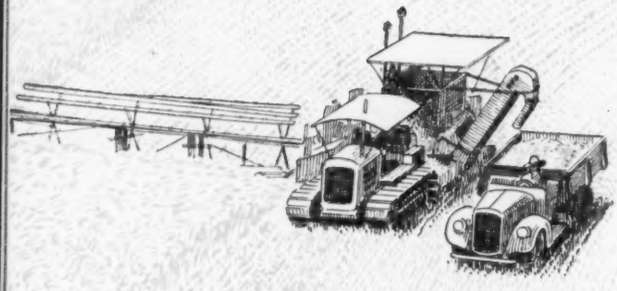
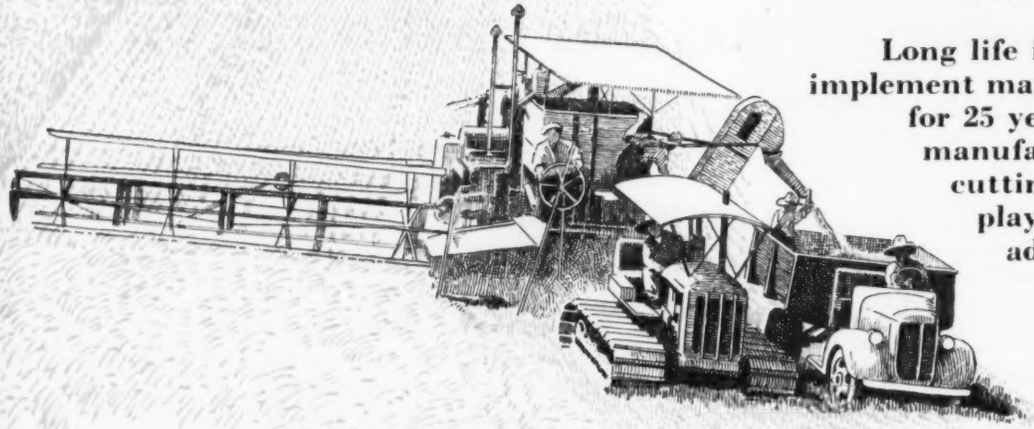
A LUBRICANT FOR EVERY INDUSTRIAL NEED

Panzers in Peaceful Valleys







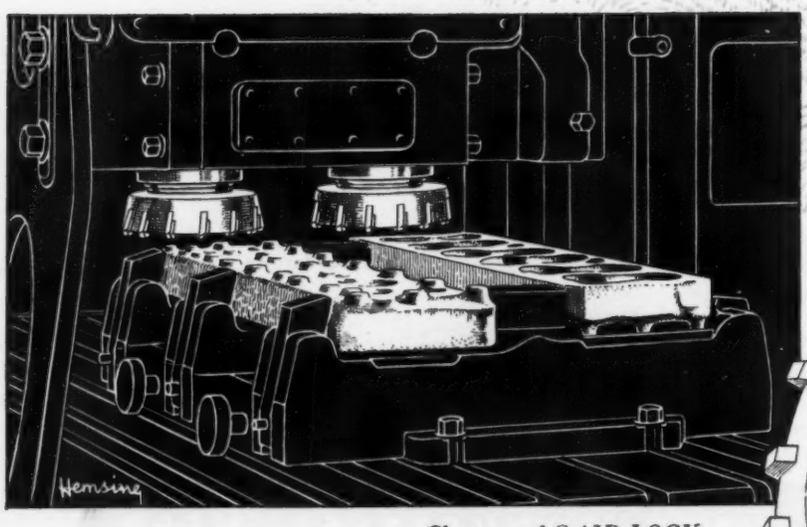
Victory depends not alone upon the legions at the front.

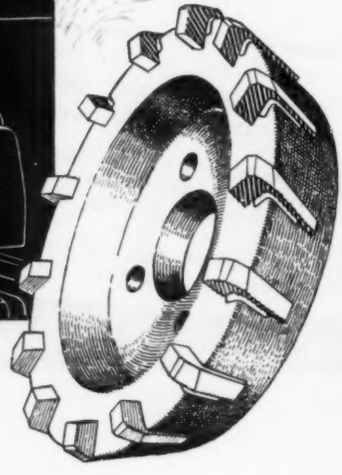
The mechanized divisions that till and sow and reap thousands of miles from the battle fury . . . they, too, share in the responsibility.

To increase food production and conserve man-power, these tank corps of the farm must function smoothly, without interruption.

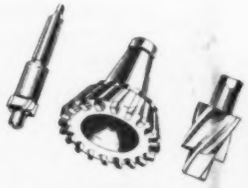
Long life is built into them by implement manufacturers and Gairing for 25 years has supplied these manufacturers with the finest cutting tools . . . tools that play an important part in adequately arming panzer divisions working in peaceful valleys.

THE GAIRING TOOL COMPANY
Detroit, Michigan





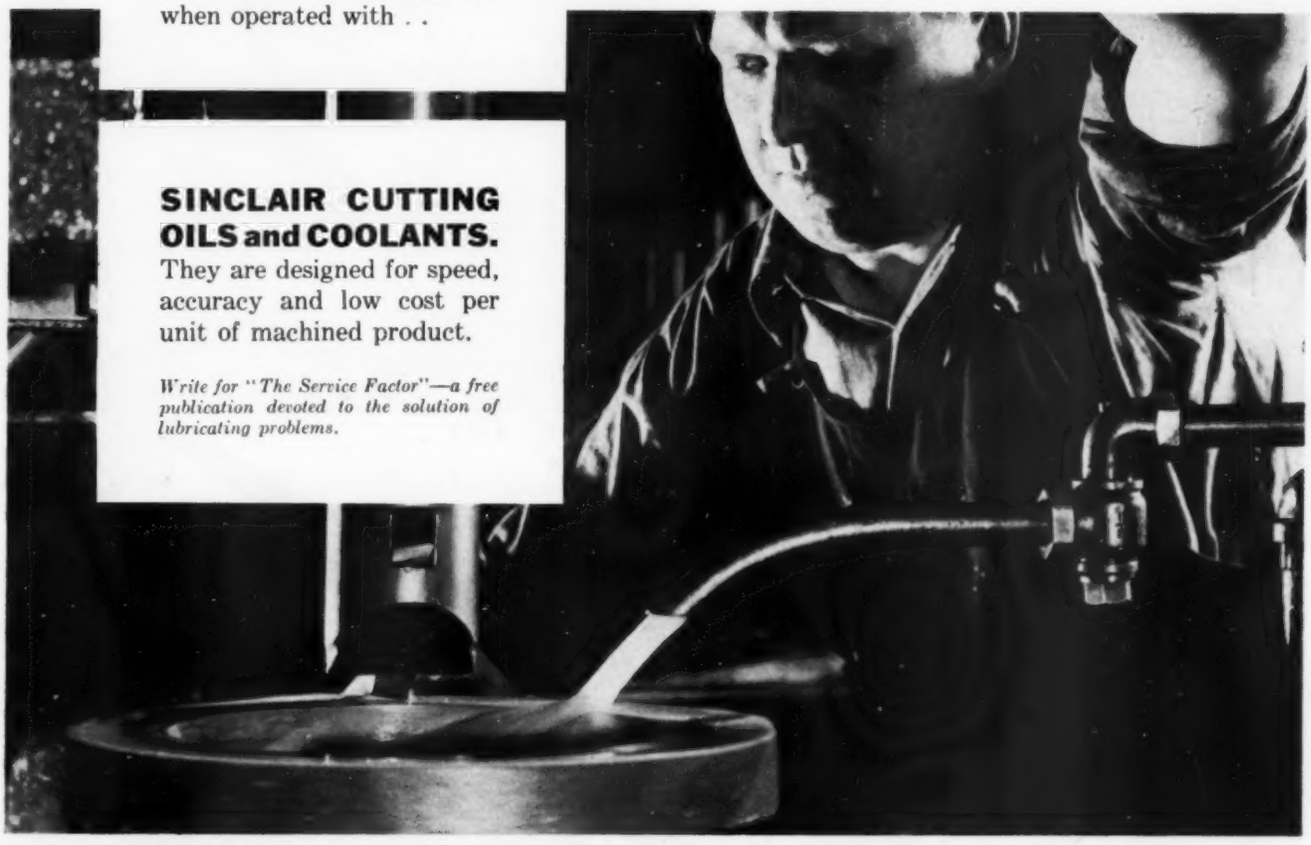
Close-up of GAIR-LOCK inserted blade milling cutters simultaneously machining two tractor engine cylinder heads



Gairing TOOLS

GAIRING
FOR A QUARTER CENTURY SPECIALISTS IN FINE CUTTING TOOLS

WINNING EFFORT
demands top speed with satisfactory finish. *MACHINE TOOLS* make more and better cuts on fewer regrinds when operated with . .



SINCLAIR CUTTING OILS and COOLANTS.
They are designed for speed, accuracy and low cost per unit of machined product.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

FROM FACTORY TO FIRING LINE

In Less Time *wit* ATKINS

New Segmental Cold Saw Unsurpassed for High Speed Shell Stock Cut-Off!

● Here's a typical example of how Atkins Saws are coming through with unprecedented production on vital armament jobs. A 28-inch Atkins Curled-Chip Segmental Cold Saw is reported as cutting 3-5/16" round shell stock, nested, in 4 minutes! If your plant is engaged in shell manufacturing, you will want full data at once on the production-boosting potentialities of Atkins Curled-Chip Saws.

The illustration at the right shows a section of an Atkins Cold Saw with teeth replaceable in segments. It also shows the characteristic shape of the Atkins Curled-Chip Tooth — a new tooth form that has revolutionized metal sawing. This tooth bites into metal like a lathe-cutting tool, removing metal in curled-chips, permitting enormous increases in cutting rates.

An Atkins engineer will gladly go over your cutting problems with you, and recommend a saw that will handle your work faster and with greater efficiency than you may have thought possible.

E. C. ATKINS AND COMPANY
Indianapolis, Indiana

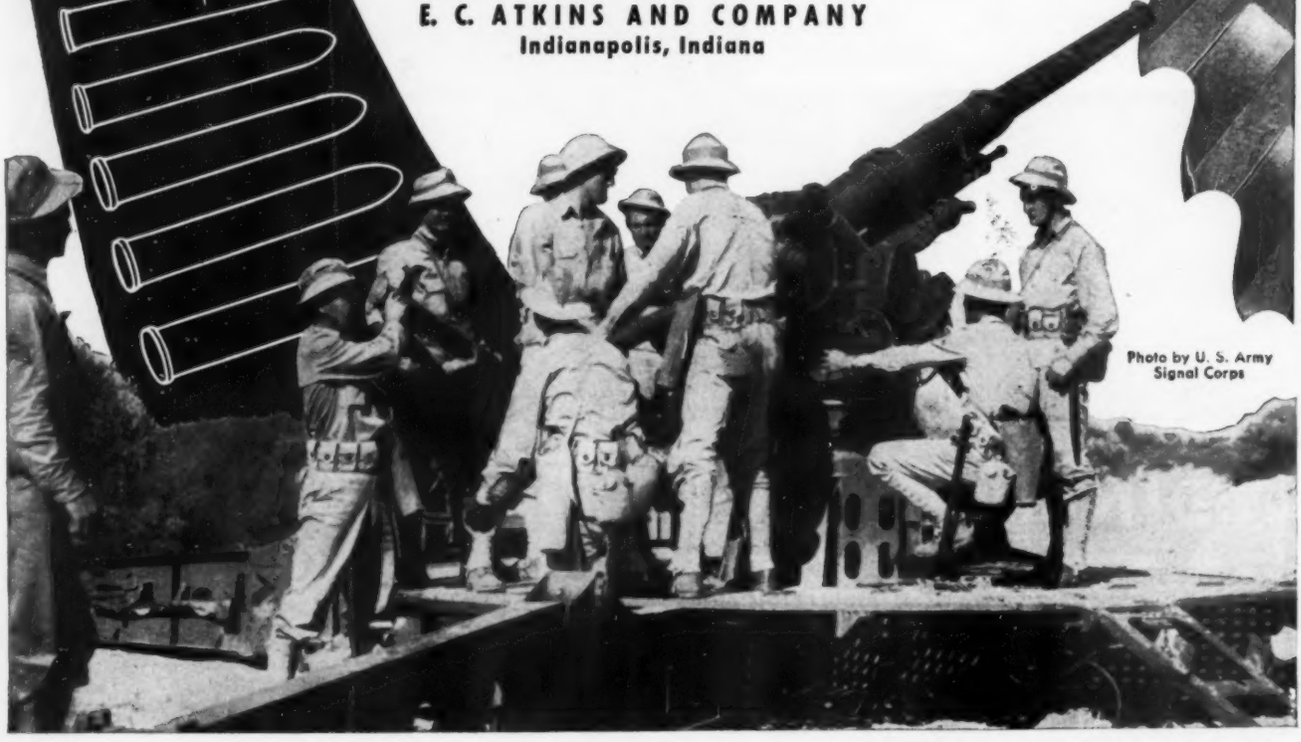
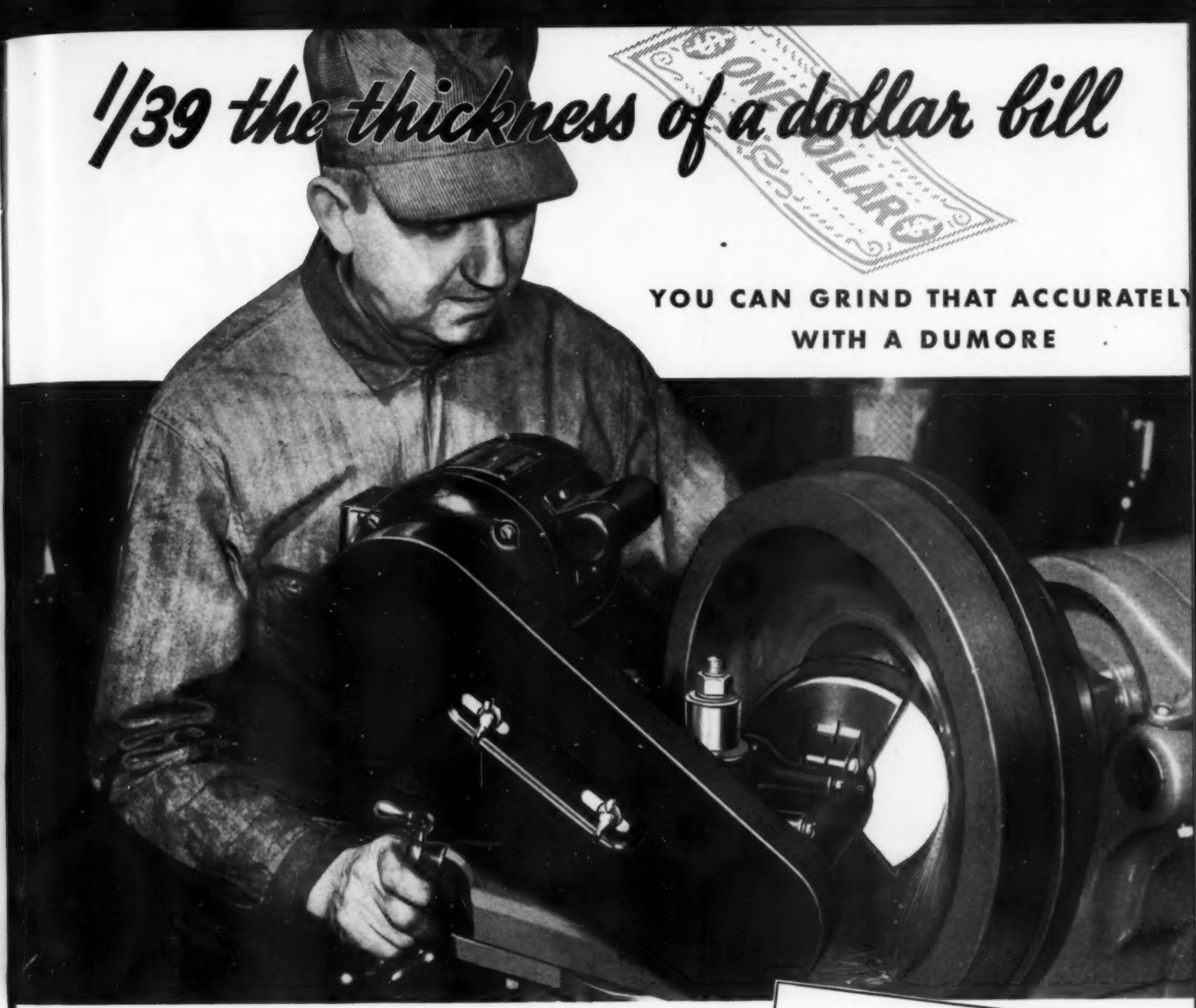


Photo by U. S. Army Signal Corps

1/39 the thickness of a dollar bill



YOU CAN GRIND THAT ACCURATELY WITH A DUMORE

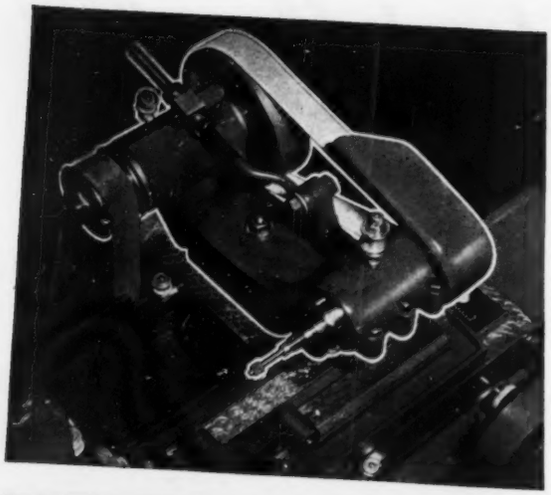
Unusual applications of Dumore Precision Grinders are daily occurrences in tool rooms and machine shops. Here, for instance, a Dumore No. 77 with external quill is grinding down a heavy duty clutch face. Flexibility, plus delicately controlled accuracy . . . to .0001". . . is responsible for surprising savings in labor costs . . . elimination of delays and reduction of spoilage on grinding jobs, internal and external. Mount Dumore Grinders on lathes, shapers, milling machines, or other machine tools . . . modernize your old machinery . . . increase the efficiency of your new equipment. Whether your grinding problem is a delicate finishing operation or heavy hogging work, there is a Dumore Precision Grinder to fit your needs. Get all the facts at once. Call the Dumore Industrial Distributor in your city or write, today.

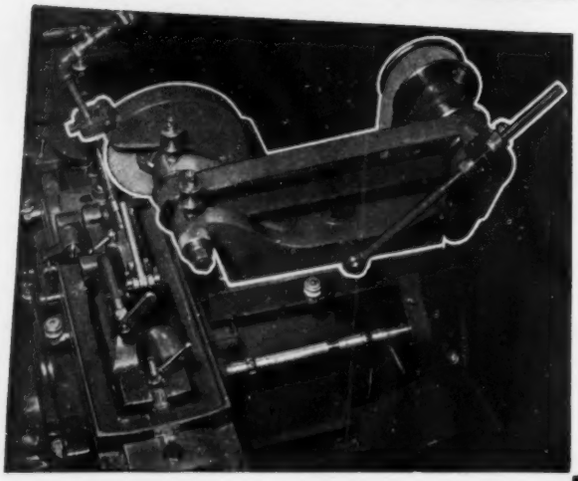
THE DUMORE COMPANY, Dept. 132-G, Racine, Wis.

WRITE FOR THIS HELPFUL INSTRUCTION BOOK ON PRECISION GRINDING

Care in operation of equipment is a vital wartime necessity. For this reason, the Dumore Company now offers free of charge this practical hand book which regularly sells at 25 cents. Write for your personal copy today.

Dumore PRECISION Grinders





Internal-External Grinding

INTERNAL GRINDING

Internal spindle is driven by belt from main drive motor, as shown at left above, at speeds up to 35,000 r.p.m. Holes from the smallest up to 3" diameter can be ground with maximum 4" power or 11" hand table reciprocation.

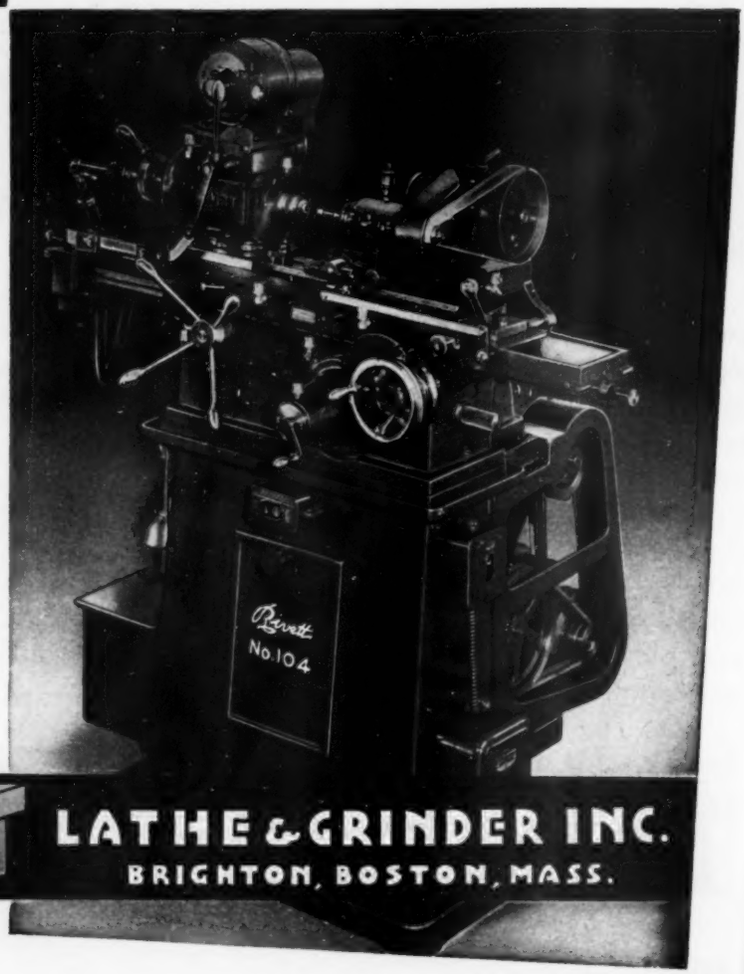
EXTERNAL GRINDING

External grinding attachment readily interchanges with internal spindle bracket on the cross slide, as shown at left, and is used for grinding straight and taper diameters or bevels. A wheel up to 6" maximum diameter by 1/2" face can be used.

RIVETT No. 104 GRINDER

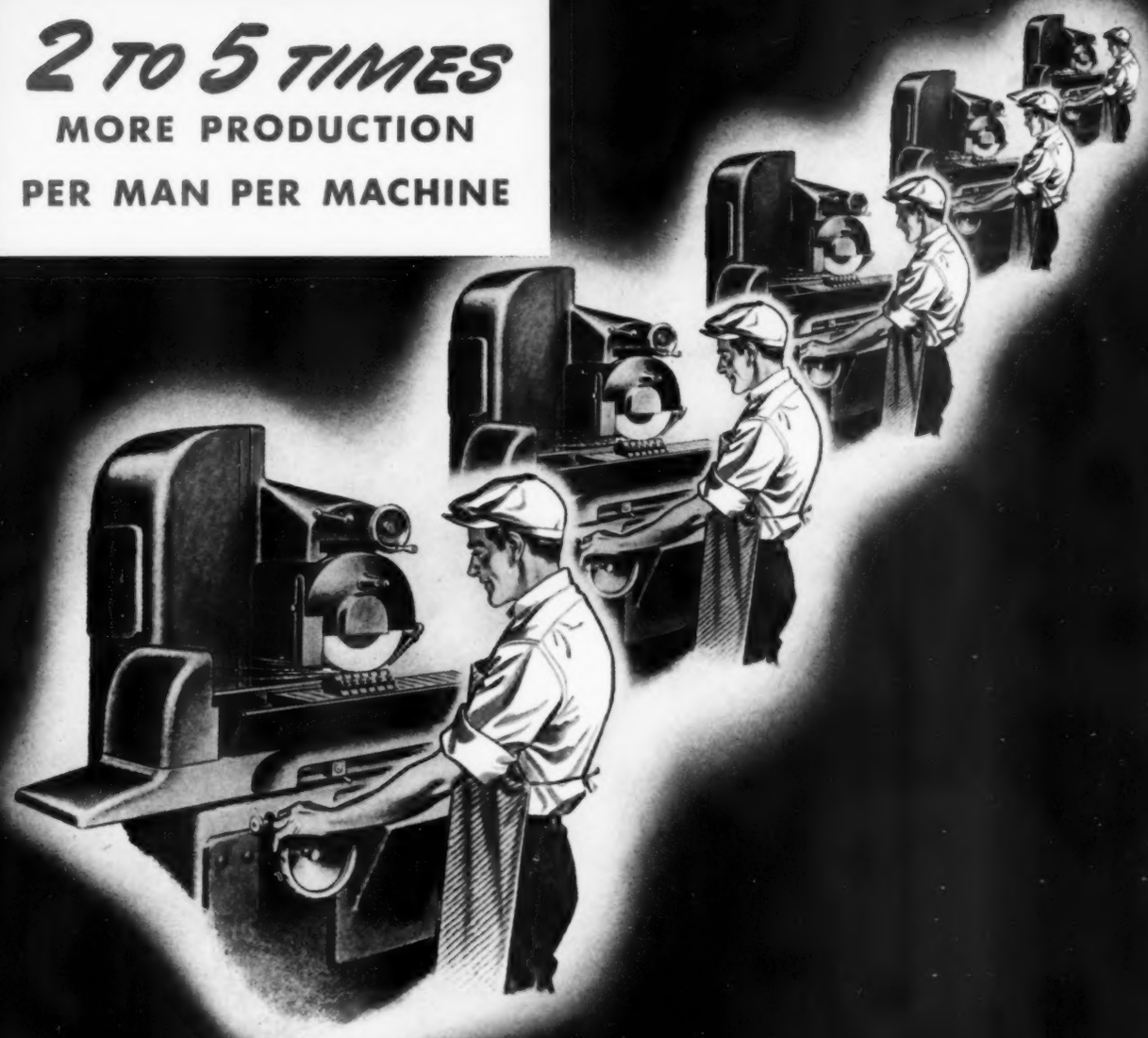
is designed to meet the demand for a small grinder suitable for precision tool making and accurate manufacturing. It may be used as a single-purpose production machine or for the many internal and external grinding requirements of the tool room. Its ease of set-up and wide range of adjustment make it more economical on small lots of parts than a heavier machine.

Although primarily an internal grinder, an external grinding attachment is offered to interchange with the internal spindle bracket. The Rivett fixed diamond is used both for truing either internal or external wheels and for maintaining sizes on duplicate work. For further information write for bulletin 104-C.



RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

2 TO 5 TIMES
MORE PRODUCTION PER MAN PER MACHINE



This new precision grinding wheel "breathes." Millions of air cells cool. Result: 100% to 400% faster cutting

Copyright 1942 by A. P. DE SANNO & SON, INC.

FIGURE THE EFFECT on your production of speeding up grinding from 100% to 400%. This new grinding wheel may do it for you, too.

The principle of Por-os-way is new. The method of manufacture is new. The bond used is new. Instead of a "sandy" or compact structure, Por-os-way is *cellular* and "stringy" like a sponge; contains millions of air cells which cool each grinding point between contacts.

Por-os-way takes deeper cuts, breezing through .010" or more. It grinds from 100% to 400% faster. It increases production per man, per machine 2 to 5 times. And that's not all. Por-os-way shows little tendency to load or burn the work. Use it on hard tool and die steels. It is hard, tough, holds its corner with very little dressing.

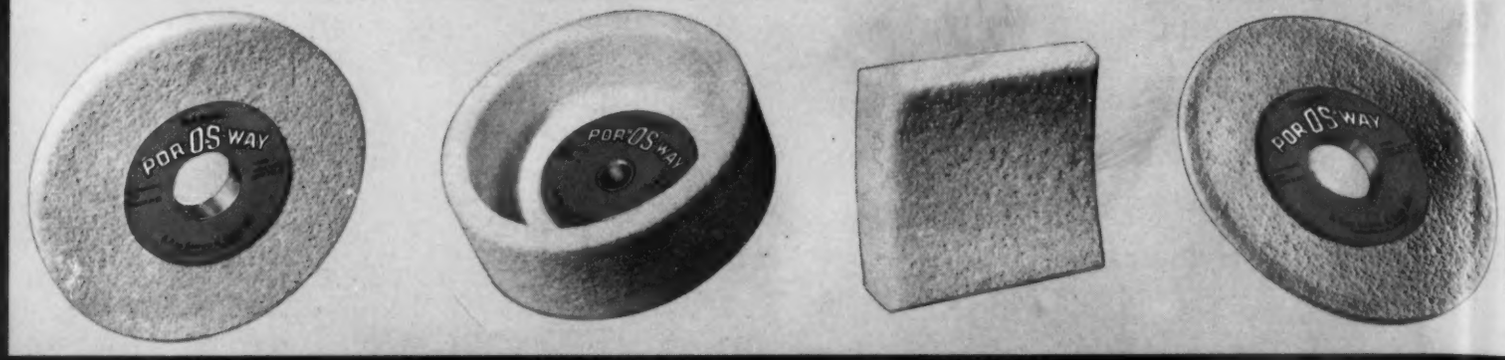
On soft materials—copper, rubber, wood, plastics—Por-os-way is free cutting and does not easily load. Make a test! Write today for the booklet that "tells all" about Por-os-way and that opens the way for the prescription of porosity, grade and grain best fitted for your job. Por-os-way wheels are not "stock" wheels. A. P. DE SANNO & SON, INC., 430 Wheatland St., PHOENIXVILLE, PA.

POR-OS-WAY* *a new* RADIAC* PRODUCT

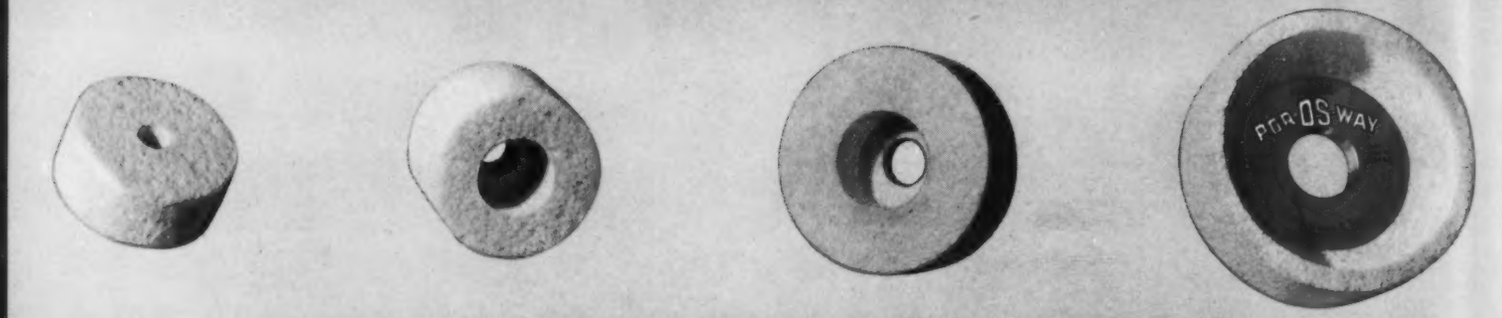
(TURN PAGE, PLEASE)

A PRECISION WHEEL FOR PRECISION PURPOSES AND EVERY WHEEL A POR-OS-WAY

the amazing new grinding wheel that is faster, cooler, free cutting, does 2 to 5 times more work per man per machine



STRAIGHT | STRAIGHT CUP | SEGMENTS | DISH



STRAIGHT | STRAIGHT RECESSED | STRAIGHT RECESSED | STRAIGHT CUP

FLARING CUP | STRAIGHT

POR-OS-WAY* *a new* RADIAC* PRODUCT

*T. M. REG. U. S. PAT. OFF.

A. P. DE SANNO & SON, INC., 430 Wissahickon Street, PHOENIXVILLE, PENNA. • SINCE 1893

Offices and Warehouses in Pittsburgh, Cleveland, Detroit, Chicago, Los Angeles

DO THIS—MAKE THE LIGHT TEST

Hold a Por-os-way wheel up to a light bulb. Note the even spread of light. No soft spots to wear away quickly, no dense spots to encourage glazing. The light is evenly diffused. The uniform structure of the wheel gives you uniform wear.

New PAGE ELECTRODE *helps to Speed tank production*

Reading Time: 43 seconds

☆ *How many additional land battleships roll into action because of the new electrode* PAGE *developed for armor welding? Not until Victory brings Peace can it be told.*

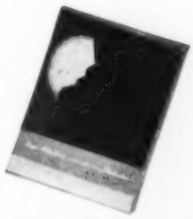
You may be sure, however, that PAGE *was ready when the tremendous advantages—the greater speed—of welded construction were appreciated.*

And you also can be certain that this new PAGE *electrode successfully met all ballistic tests on plates submitted to the Army Ordnance Department by the tank manufacturers.*

Keep in mind the effect of this wider use of welding—and welding in shipyards—on your own job. See that you are using electrodes of the most economical sizes—lean toward larger diameters. Use them down to the holder. Check to prevent deposit of excess metal in the weld.

PAGE STEEL AND WIRE DIVISION

Monessen, Pa., Atlanta, Chicago, New York, Pittsburgh, San Francisco



If you are welding Stainless Steel, ask your local Distributor of PAGE *Electrodes for this booklet on* PAGE-Allegheny Stainless Steel Electrodes. *It is helpful.*

One of the new American welded tanks

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

Announcing

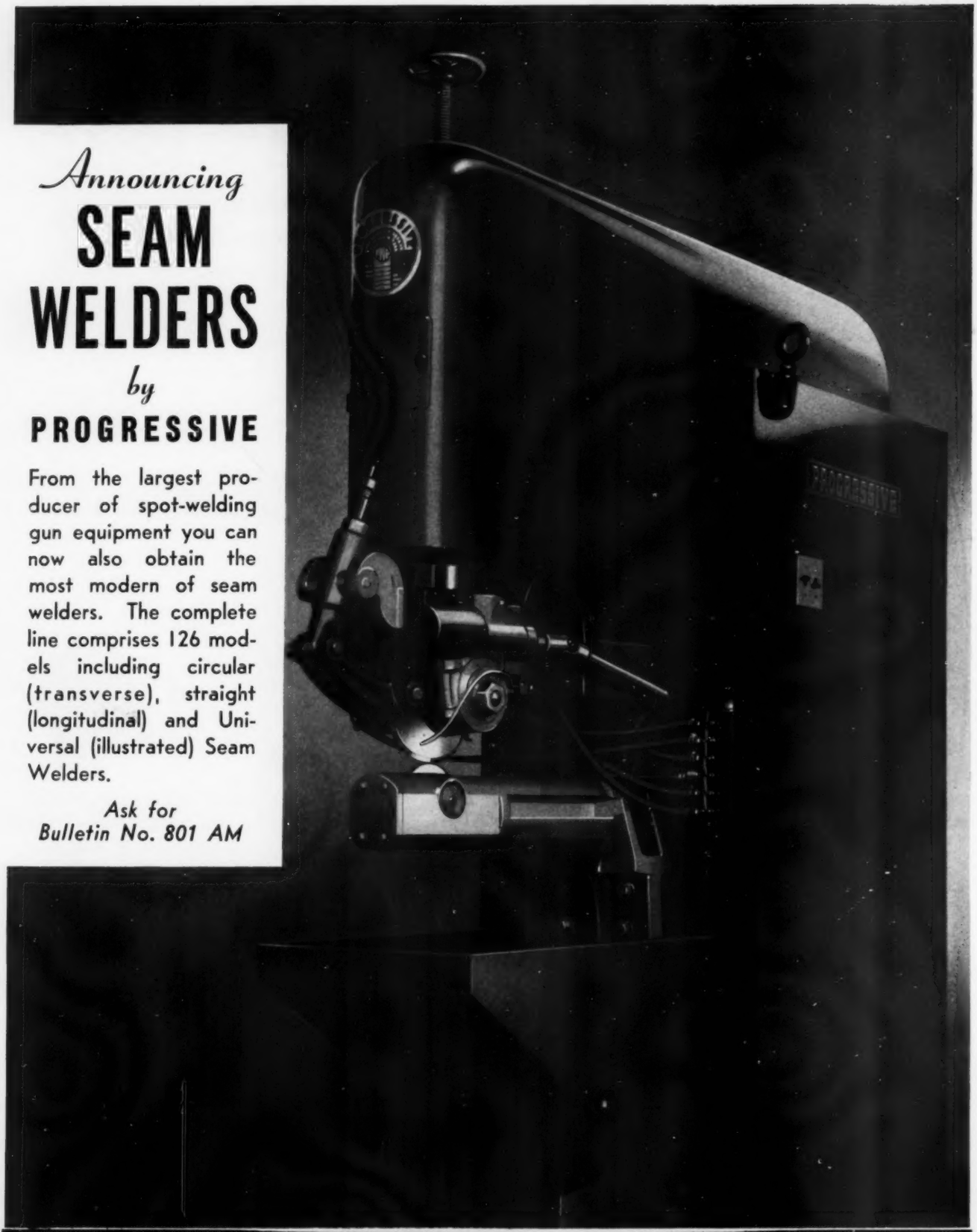
SEAM WELDERS

by

PROGRESSIVE

From the largest producer of spot-welding gun equipment you can now also obtain the most modern of seam welders. The complete line comprises 126 models including circular (transverse), straight (longitudinal) and Universal (illustrated) Seam Welders.

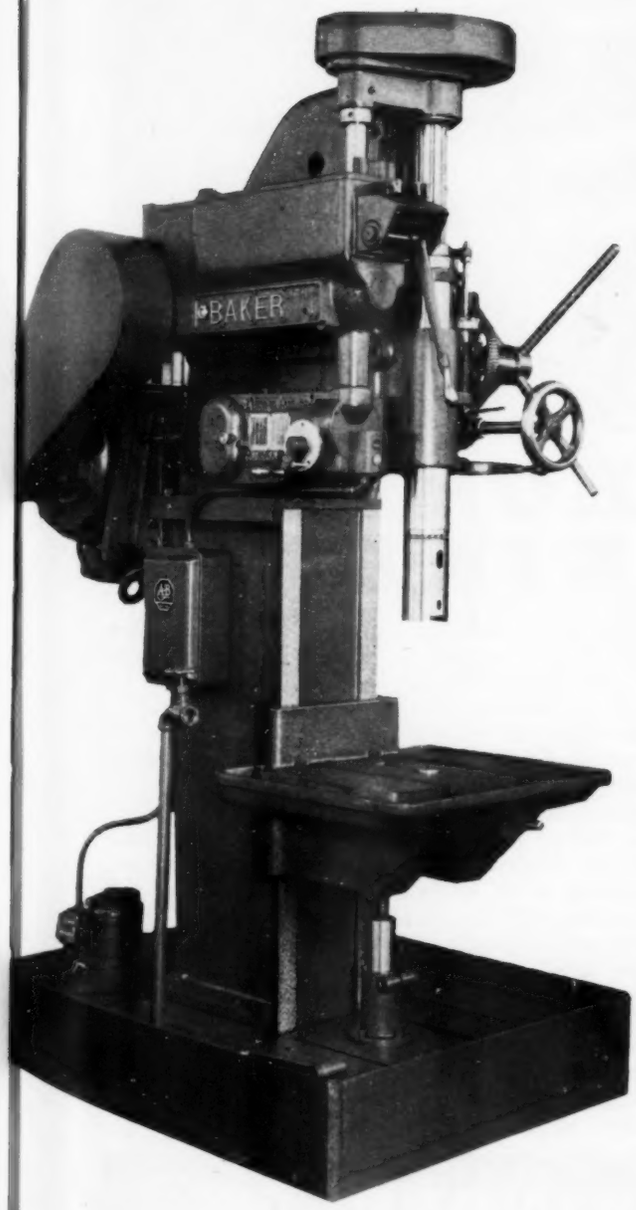
Ask for
Bulletin No. 801 AM



PROGRESSIVE WELDER CO.
3050 E. OUTER DRIVE DETROIT, U.S.A.

Baker's Model 314-A

. . . A HEAVY DUTY, HIGH PRODUCTION UNIT THAT'S IDEAL FOR DRILLING OPERATIONS ON TANK PARTS, AIR-CRAFT ENGINES, GUN MOUNTS AND OTHER VITAL WAR PRODUCTS



Here's a unit that's designed and built to meet today's production conditions — BAKER'S MODEL NO. 314-A. Essentially a Heavy Duty Drilling Machine, the 314-A can absorb excessive punishment, and give highest production at the same time. You'll find these models doing their share on numerous war production operations . . . drilling all kinds of material . . . providing outstanding economies. 314-A's are surely a sound investment, both for present war work and future operations. Why not investigate them, as applied to your drilling operations? We can assure reasonable delivery—write for our latest folder, or call us regarding a specific job to be done.

THE 314-A . . .

CAPACITY . . . drives High Speed Twist Drills up to 3" diameter, to the limit of their efficiency in steel. Can be adopted to boring, counterboring, facing, forming and tapping operations.

CONSTRUCTION and DESIGN . . . two-piece vertical column, to give increased flexibility. Spindle is of forged high-carbon steel, multi-splined, with the spindle nose carrying a No. 5 Morse Taper.

SPEEDS . . . six quick changes of speeds are provided. Speed change control lever allows instantaneous changing of speeds through sliding hardened gears.

DRIVE . . . unit is furnished motor driven only, with motor mounted on pivoted base to rear of machine. Vee-belts transmit power—number of belts used dependent on h.p. used. Machine as standard furnished with reversing control suitable for hand tapping.

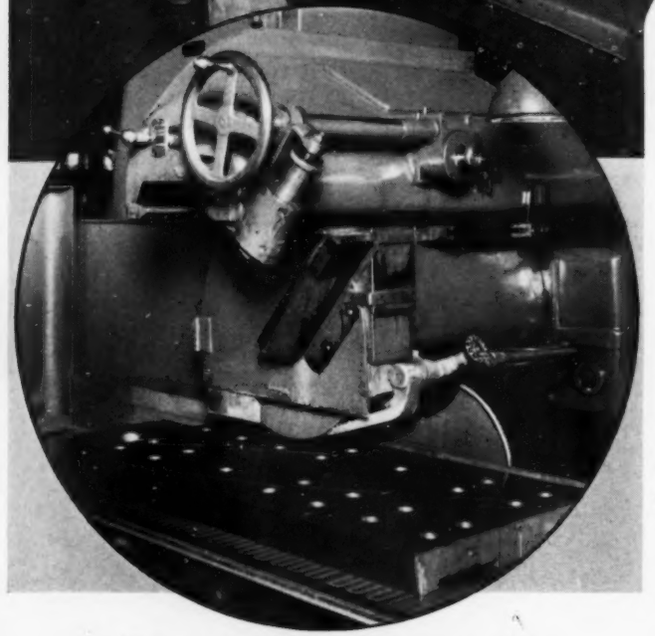
BAKER

OUR MOTTO SINCE 1867 "MACHINES: STURDY and EFFICIENT, AS FINE AS CAN BE BUILT . . ."

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

DRILLING • BORING • TAPPING AND KEYSEATING MACHINES

MORE MACHINES *for more* WEAPONS *of* WAR



Close up of grinding operation on top side of Ram Guides

THOMPSON GRINDERS

The thousands upon thousands of machines used on the widely scattered areas of war require more and more machine tools to keep on top of steadily increasing requirements.

This Type C Grinder is one of hundreds of Thompson Grinders now engaged in building machines used for war production.

In this instance the Thompson Grinder is grinding a pair of Ram Guides for an all steel press made by a leading press brake manufacturer. Each guide is 10" wide by 38½" long—is ground top, bottom and both ends. Rough and finish grind operations are required to tolerances of .0005 inch on the 38½" length. Floor to floor time for one pair of Ram Guides is 5 hrs.

Full hydraulic drive to table and wheel head insure smooth shockless operation with better finish and closer tolerance work.

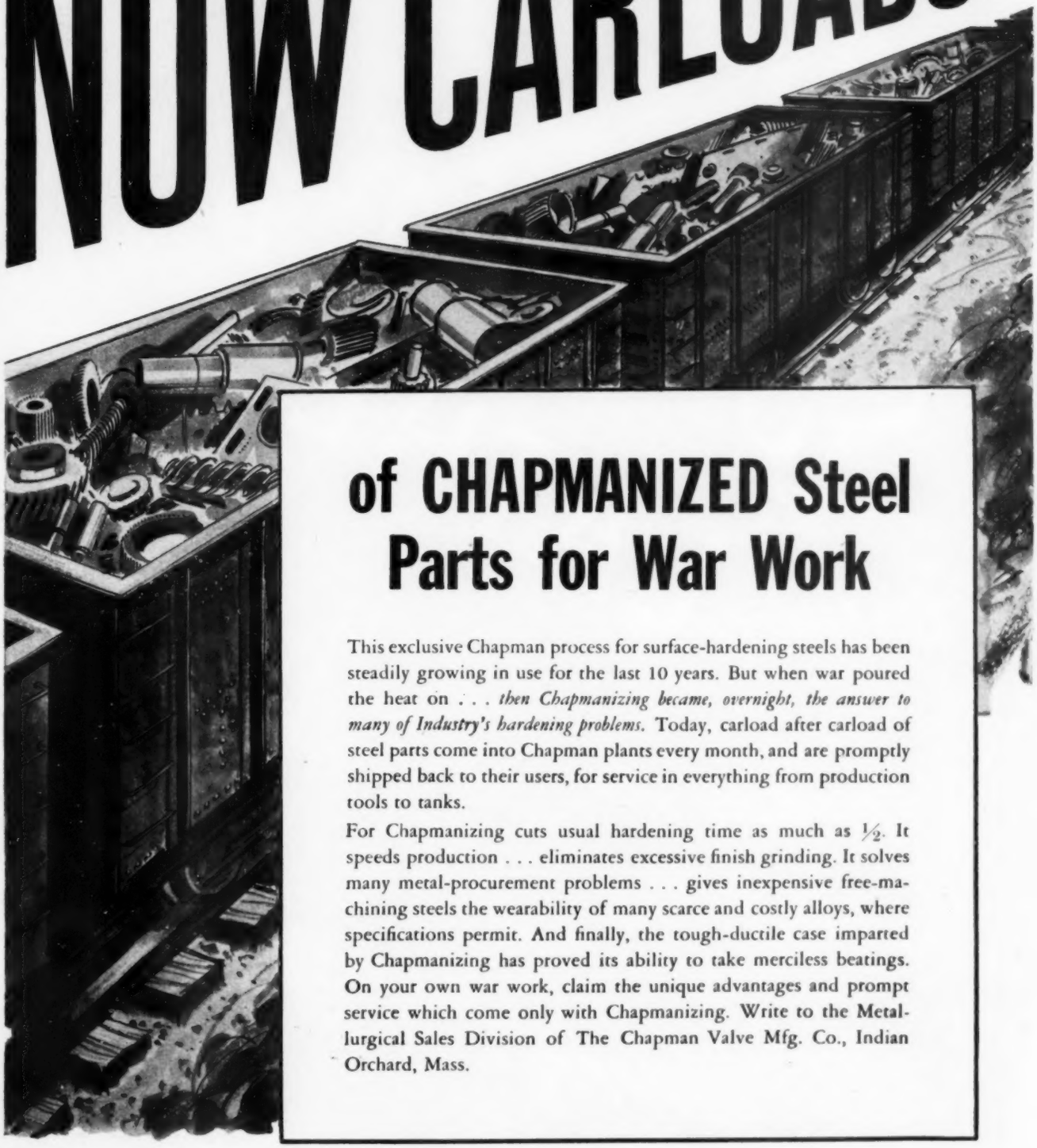
Complete details contained in full descriptive bulletin. Write for yours.

THE THOMPSON GRINDER CO.

Completely Covering all Normal Ranges of Surface Grinding Requirements

SPRINGFIELD, OHIO, U. S. A.

First...TONS NOW CARLOADS..



of CHAPMANIZED Steel Parts for War Work

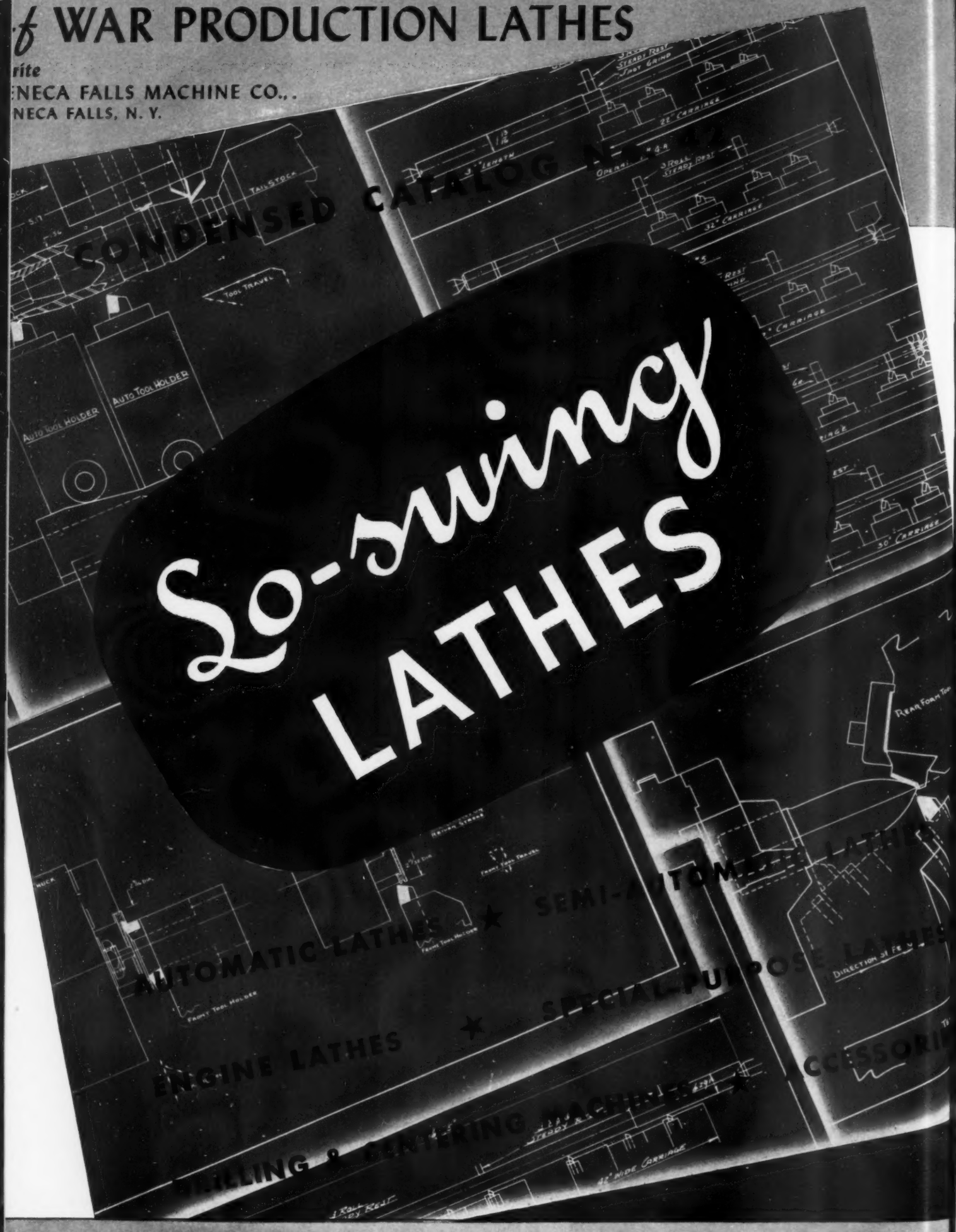
This exclusive Chapman process for surface-hardening steels has been steadily growing in use for the last 10 years. But when war poured the heat on . . . *then Chapmanizing became, overnight, the answer to many of Industry's hardening problems.* Today, carload after carload of steel parts come into Chapman plants every month, and are promptly shipped back to their users, for service in everything from production tools to tanks.

For Chapmanizing cuts usual hardening time as much as ½. It speeds production . . . eliminates excessive finish grinding. It solves many metal-procurement problems . . . gives inexpensive free-machining steels the wearability of many scarce and costly alloys, where specifications permit. And finally, the tough-ductile case imparted by Chapmanizing has proved its ability to take merciless beatings. On your own war work, claim the unique advantages and prompt service which come only with Chapmanizing. Write to the Metallurgical Sales Division of The Chapman Valve Mfg. Co., Indian Orchard, Mass.

READY!... *New Catalog*

of WAR PRODUCTION LATHES

Write
SENECA FALLS MACHINE CO.,.
SENECA FALLS, N. Y.



LATHE NEWS from SENECA FALLS

MALLORY STANDARDIZED WELDING ELECTRODES

SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST

This Hot Shower Puts the Heat on Wartime Production..

Sparks fly high, wide and handsome when this flash welder goes into action. The versatile process it makes possible . . . which has in the past found many applications in the automotive industry . . . now becomes a "big shot" in wartime production. Flash welding is ideal for fast, clean welding of relatively large cross sections—rods, bars, sheets, plates, pipe, stampings, forgings, channels, angles and other shapes.

Dies for flash and butt welding must be made of materials that withstand high temperatures and pressures day after day . . . and Mallory provides exactly the right material for each specific job.

For flash welding heavy stock, for instance, solid inserts of Mallory 73 Metal or Elkonite-faced inserts in the dies offer high resistance to both abrasion and flashing . . . combining excellent physical and electrical properties. With these Mallory dies, thousands of welds are made regularly before redressing is necessary.

When irregular sections of thin stock are being flash welded, Elkonite inserts are your best choice, since they maintain their contours in heavy production so that the pieces being welded are always accurately aligned. *Result:* stronger, cleaner welds.

Specify Mallory dies or electrodes, and you'll benefit from the most advanced developments in alloy research, design and cooling. Also your requirements will be met *promptly*, thanks to Mallory's standardization program on resistance welding.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA *Cable Address* — PELMALLO

This Elkonite-faced die resists both abrasion and flashing . . . produces strong welds by the thousands before it needs redressing.

MALLORY

Resistance Welding Data Book

Be sure your engineering files include this factual, complete treatise on resistance welding practices, alloys and specifications. Write for your copy today.

RESISTANCE WELDING P. R. MALLORY & CO. Inc. MALLORY **STANDARDIZED ELECTRODES**

Rescue

St. Bernard

. . VITAL MACHINERY FROM ABRASIVE DUST

Is dust running wild in your plant, injuring valuable machinery and menacing your employees' health and efficiency?

Rescue your equipment by harnessing this enemy with one or more *TORIT Self-Contained Dust Collectors.* Easy and economical to install—only a few pieces of piping or flexible tubing required. Torits are portable and may be placed wherever needed. In many instances the installation of several TORIT DUST COLLECTORS has been found more practical than one small central system.

GET THE FACTS—Write today for bulletin giving Torit advantages, numerous uses, construction and operation data, models and prices. Let us solve your "dust control" problem.

Traps dust from grinding and buffing wheels instantly!

TORIT Manufacturing Co.
280 Walnut Street
St. Paul, Minnesota

TORIT Dust Collectors
SELF-CONTAINED UNITS

DOES THIS HAPPEN IN YOUR SHOP:

1. Do your cutting oil emulsions spoil? Do they give off foul odors? Separate?

2. Do the men have dermatoses resulting from cutting oil?

The subject of cutting oil sanitation is completely covered in a new booklet. It details a new approach to this problem, and points the way to maintaining practical sterility of cutting oils. Without charge, Dolge will examine your cutting oil—will determine the bacteria count. If sanitation is indicated, you will receive recommendations in keeping with your particular working conditions.

Send for Booklet SM-4

THE C. B. DOLGE CO.
WESTPORT DOLGE CONN.

FREE 36 PAGE BOOK • Write Today!

Castolin EUTECTIC LOW TEMPERATURE WELDING

Aluminum

Iron

Steel

THIS new low temperature method has revolutionized welding. With Castolin Eutectic Low Temperature Welding it is possible to salvage castings already machined as well as brand new but defective castings. It gives a completely machinable, color matched, distortion-free weld.

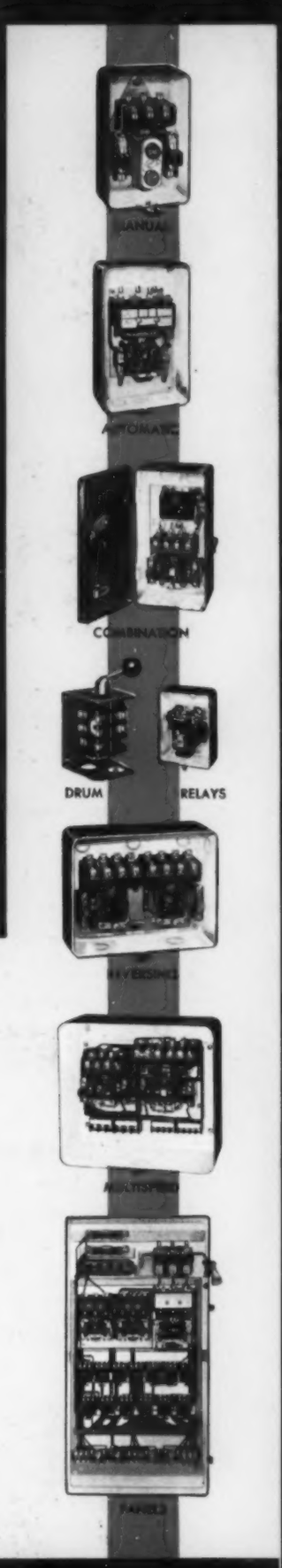
Welds: Cast Iron, Iron, Nickel, Steel, Aluminum, Bronze, Copper, Brass, Magnesium, etc.

CHECK THESE ADVANTAGES

- High Strength
- Matching Color
- Less Stresses
- Less Warping
- Less Preheating
- Greater Economy

Some Territories Available for Manufacturers' Representatives.

EUTECTIC WELDING ALLOYS, Inc.
40 Worth St., New York, N. Y.



There is an

ALLEN-BRADLEY CONTROL

for every operating requirement

Allen-Bradley Bulletin 709 solenoid starter—open type construction.

The heart of the Allen-Bradley line is the A-B solenoid switch. Its accurate and instantaneous response to pilot controls and its amazing record of lifetime service without contact maintenance are giving machinery builders valuable opportunities for stepping up machine outputs.

Allen-Bradley solenoid controls are available in an exceptional variety of standardized types, ratings, and enclosures. With standard A-B units you can solve practically any special control requirement. Send for "The Story of the Solenoid Starter"... and read how modern control can serve you.

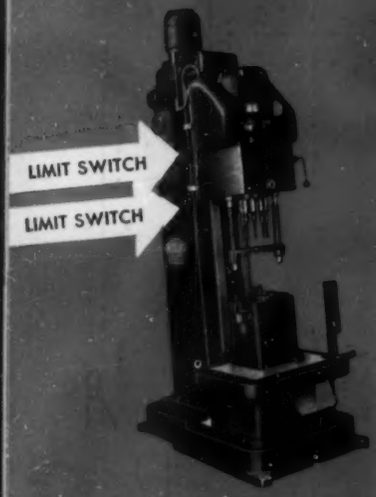
A-B SILVER ALLOY, DOUBLE BREAK CONTACTS NEVER NEED CLEANING

A-B Quality

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY



Bradford Drilling and Tapping Machine with A-B Limit Switches.

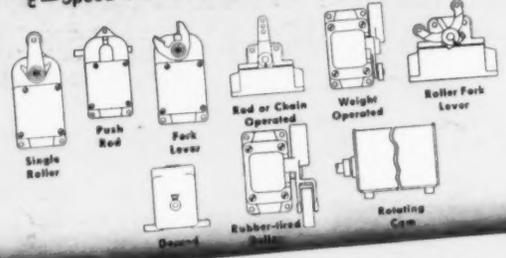
Baker No. 1 Key Seater with A-B Precision Limit Switches.

A QUICK and EASY WAY to solve your LIMIT SWITCH problems

Select standard Allen-Bradley controls to fit any special limit switch requirement

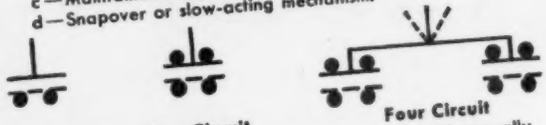
1st— Determine the type of mechanical motion

a—Straight-line, curved, or rotary.
b—Length of travel and overtravel.
c—Speed and force of movement.



2nd— Take advantage of wide variety of contact arrangements

a—Number of circuits.
b—Interrelation of circuits (normally open or normally closed).
c—Maintained or spring-return contacts.
d—Snapover or slow-acting mechanism.



Single Circuit Two Circuit Four Circuit

A-B limit switches are available in a wide variety of normally closed contacts; extra relays can often be avoided.

3rd— Distinguish between standard or heavy duty service

a—Frequency of operation.
b—Severity of service.
c—Atmospheric conditions.
d—Keep pilot current within limit switch rating.

Examples of Allen-Bradley standard and heavy duty limit switches.

4th— Be sure to use the correct enclosure

a—Determine nature of application.
b—Select enclosure of correct Nema classification.

Open Dust-Tight Splash-Proof Water-Tight or Explosion-Proof

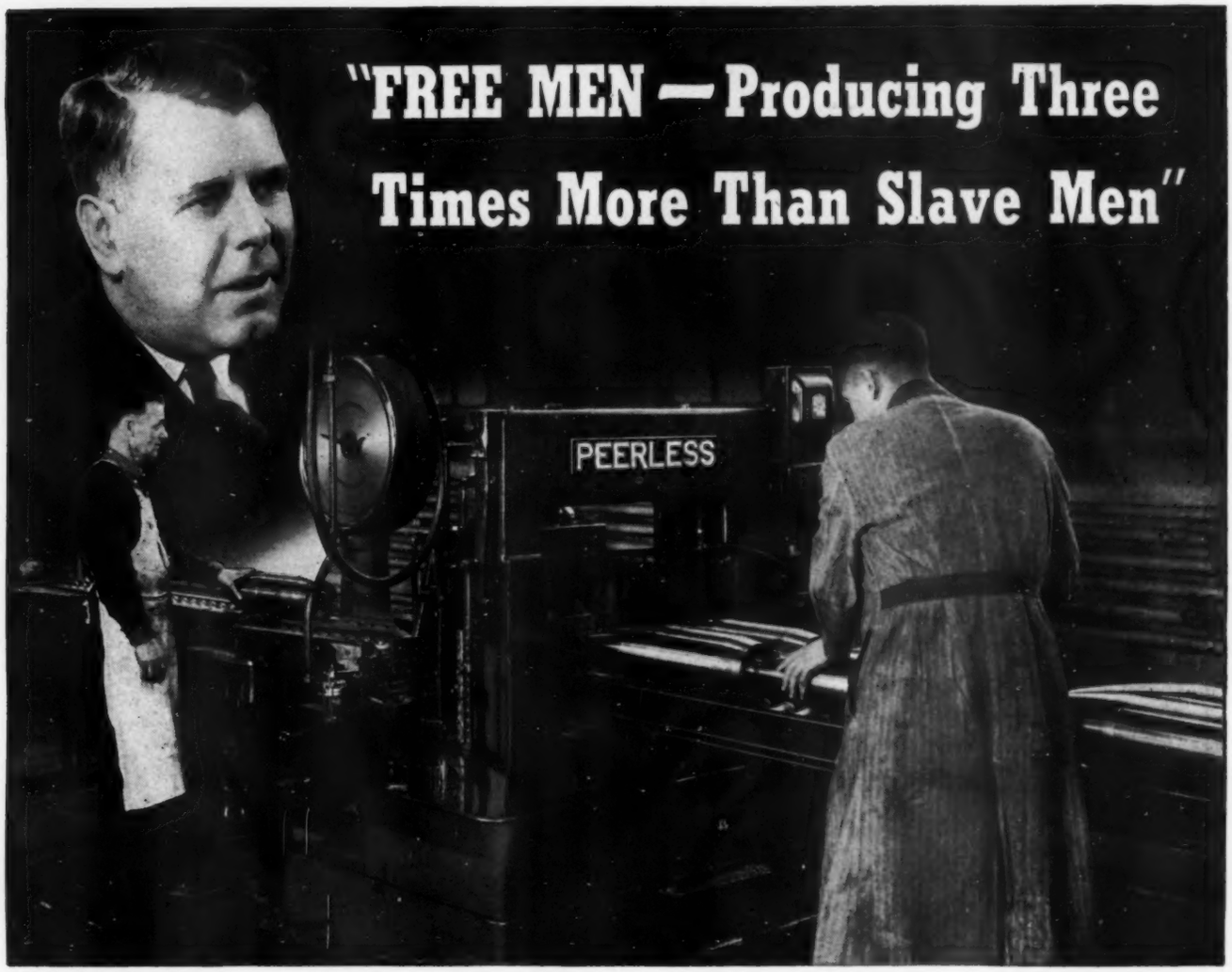
Write for Bulletin 801

Allen-Bradley Company, 1310 S. Second St., Milwaukee, Wis.

ALLEN-BRADLEY

BULLETIN 801-2 LIMIT SWITCHES

QUALITY



Peerless Saws are Helping to Save—TIME...METAL...and BLADES

PEERLESS 14" High Duty Saw, cutting butt end from 155 mm semi-finished shells. As many as 800 pieces are cut with a single, high-speed, 4 tooth, $1.50 blade.

American tools and free Americans have created a miracle of mass war production . . . have set an impossible pace for Axis slaves to follow. To help these free men produce, Peerless has made practical the faster cutting of metal.

Faster cutting has been made practical with a Peerless — the Saw with the exclusive Four-Sided Saw-Frame, and Backing-Plate Blade-Support. Besides reducing CUTTING TIME; Peerless Saws save METAL, too. The thin, cool-running, straight-cutting blade removes as little as 1/16" of the stock.

BLADE SAVINGS also count up fast in triple-shift, high speed cutting. On a Peerless High Duty as many as 800 butt-end shell cuts are being made with a single blade.*

These savings in TIME . . . METAL . . . and BLADES are helping free men to win, and to buy their War Bonds every pay day. More complete details on this 3-way saving will be mailed at your request.

PEERLESS MACHINE COMPANY • RACINE, WISCONSIN

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-742, Racine, Wisconsin

*Mail complete details on the performance record shown above.....

☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

Company.....

Individual.....

Street.....

City..... State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

Pictured above is the heat-treating department of a large manufacturer of Bomb Tail Fuses. Equipment consists of a Johnson Drawing and Tempering Furnace No. 820; a Johnson Hardening Furnace for Manganese Moly Steel, No. 130-LT; a Johnson No. 130 Hi-Speed Steel Hardening Furnace and a Johnson No. 550 Liquid Hardening Furnace with Standard Hood.

Your Plant Can Save Time, Gas and Valuable Floor Space with Johnson Furnaces

Owners of Johnson Furnaces save production hours with these units, as every Johnson Furnace reaches maximum temperature in less than 30 minutes. The compact construction saves needed floor space; all Johnson Furnaces are easily moved. For more than 40 years Johnson Furnaces have served industry economically. Get the facts, and you, too, will install JOHNSON. 2 weeks Delivery on Standard Johnson units carrying A1-J Priority Rating or Better.

Sales Offices:

Bourse Bldg., Philadelphia
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JOHNSON FURNACES for INDUSTRY
FOR MORE THAN 40 YEARS

FREE! Use the Coupon

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567 E. Ave. N.W., Cedar Rapids, Iowa

Please send me Free Johnson Catalog

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City ..... State .....

DOWN-HAND WELDING

• TURNING A WELDMENT FOR FASTER, BETTER,

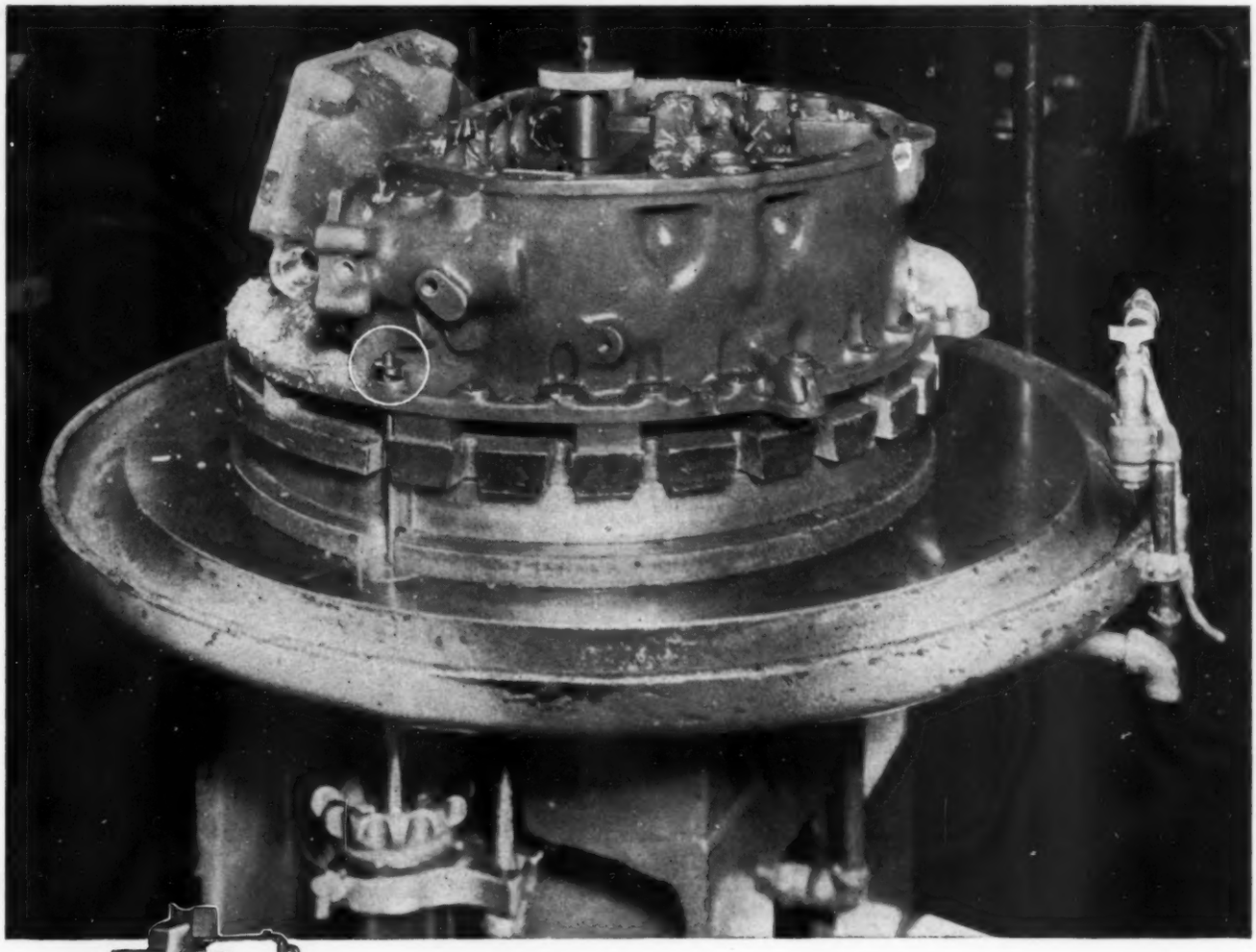
A

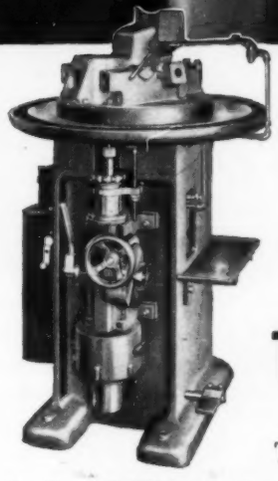
B

Cullen-Friestedt Positioners equipped with a "tailstock," (a free-turning platen mounted on a suitable stand) permits a complete rotation of heavy awkward weldments so that faster, better down-hand welding may be done. "A" shows positioner end of this set-up and "B" the other end showing the tailstock. With push-button switch, the welder has complete control of turning speed and starting and stopping at convenient welding positions.

Our NEW booklet WP 21 is just off the press giving full information about C-F Positioners in four sizes from 1200 to 14,000 lbs., capacity. Write for it.

CULLEN-FRIESTEDT CO.,
1313 S. KILBOURN AVE. CHICAGO, ILLINOIS





Par for these 18 holes on P & W engine casting . . . scored by new

TAFT-PEIRCE BACK-SPOTFACING MACHINE

This magnesium blower casting for Pratt & Whitney aircraft engines has 18 holes that must be back-spotfaced—a job which cannot be done from overhead because of internal lugs. The midwestern plants working for P & W Aircraft reduced the job to its simplest terms with this Taft-Peirce precision machine.

The casting is mounted on a 28″ circular cast-iron table, near the front of which is a hole which allows the shank of an inverted counterbore to project through the table. The vertical tool spindle is raised successively through each hole and the spotfacing tool mounted on the end of the spindle. The cut is taken by feeding the tool downward, after which, the cutter is removed and the spindle withdrawn. Cutter spindle is driven through bevel gears by a ½ HP motor, is provided with fast and slow hand feeds, and is available with or without clutch for disengaging power. Write for bulletin giving complete specifications of the T-P Back-Spotfacing machine.

THE

TAFT-PEIRCE MFG. CO.

WOONSOCKET, RHODE ISLAND

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

"Johnny-on-the-spot" I CALLS IT!

"Honest delivery dates mean everything in these days of hurried war production. That's why we cheered when our last Zip-Lift arrived on the date promised. In no time at all we had it plugged in — handling loads 'thru the air' — replacing back power with push buttons — giving production a lift."

And it's "Johnny-on-the-spot" around machine tools, along assembly lines, in foundries, on loading platforms, etc., wherever loads must be handled frequently. Available for bolt, hook or trolley mounting. Ready for use on any standard lighting circuit. It's the quality hoist in the low-price field.

P&H ZIP-LIFT

CAPACITIES 250, 500, 1000 pounds

General Offices: 4514 West National Avenue, Milwaukee, Wis.

HARNISCHFEGER CORPORATION

HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

SALT LOSS *Slows Up Production*

SALT lost by sweating must be replaced or workers tiro quickly — accuracy and alertness are dulled. Lowered efficiency, mistakes and accidents take their toll.

MORTON'S *Salt Tablets*

Install Morton's Dispensers by all drinking fountains, so workers can take tablets to replace the salt lost by sweating.

ORDER NOW!

Salt Tablets Case of 9000 **$2.60**

Salt-Dextrose Tablets Case of 9000 **$3.15**

Dispensers

500-tablet size **$3.25**

1000-tablet size **$4.00**

MORTON SALT CO., Chicago, Ill.

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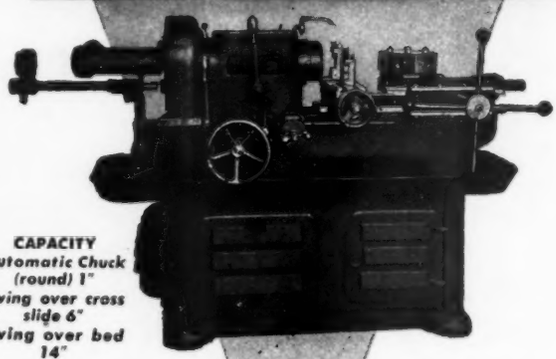
for **ECONOMY**—*for* **HIGH SPEED PRODUCTION**

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

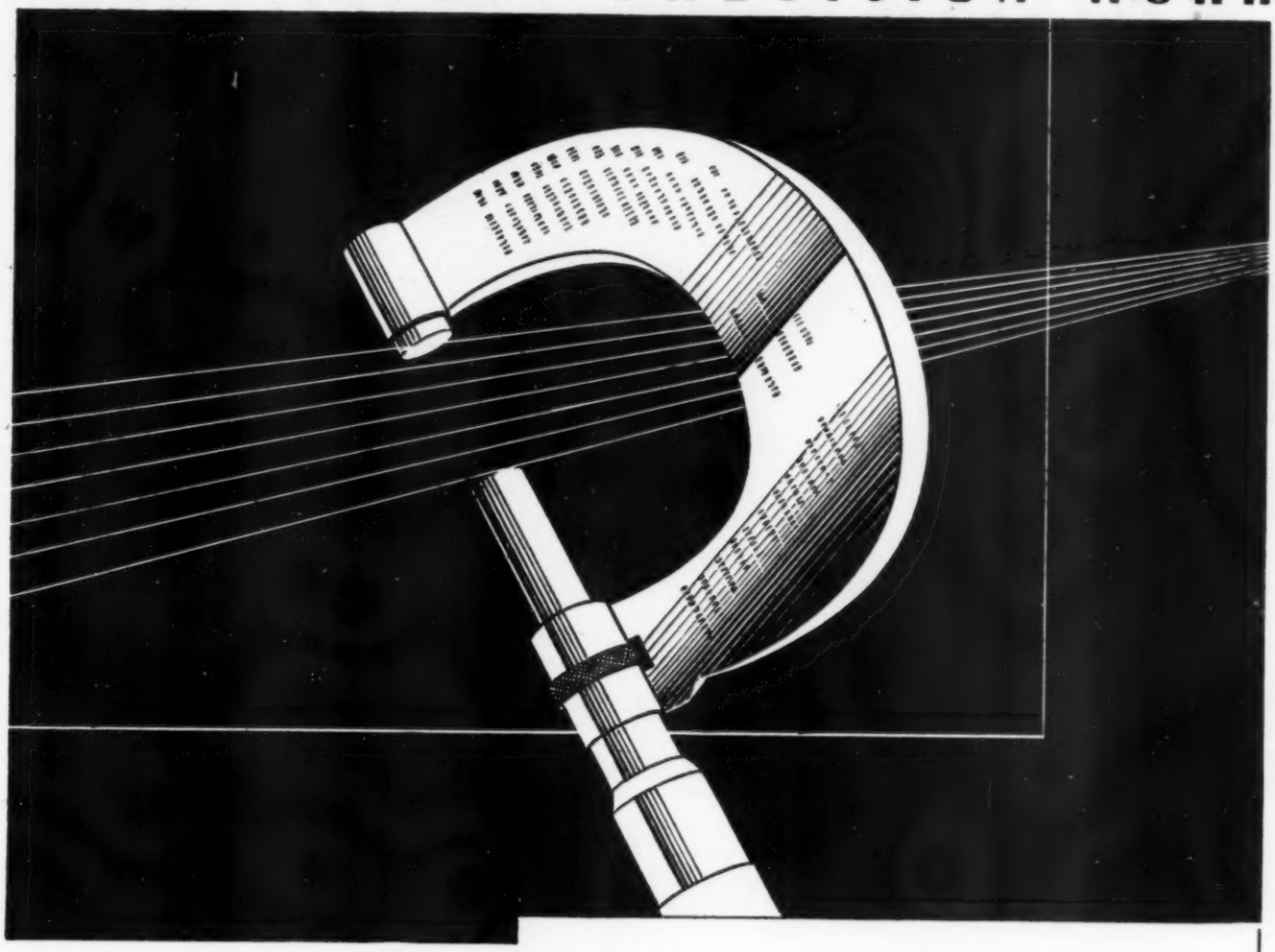
Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

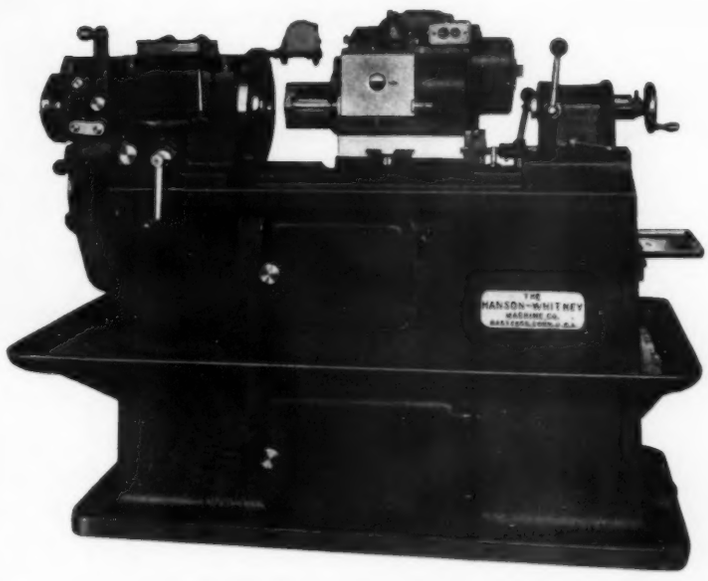
MOREY MACHINERY CO., INC

410 BROOME STREET • NEW YORK, N. Y.

FOR PERFECT PRECISION WORK



H-W Universal Semi-Automatic Thread Milling Machines are modern in every detail . . . will enable you to produce perfect, close-limit work without spoilage. The H-W Milling Process permits the working of many previously hard-to-thread materials . . . and, by applying the multiple cutter principle, threads of all lengths within the capacity of the machine are completed in one revolution. External, internal and taper threads . . . right or left hand . . . can be cut with equally high speed, precision accuracy and convenience. If you have a threading problem call Hanson-Whitney.

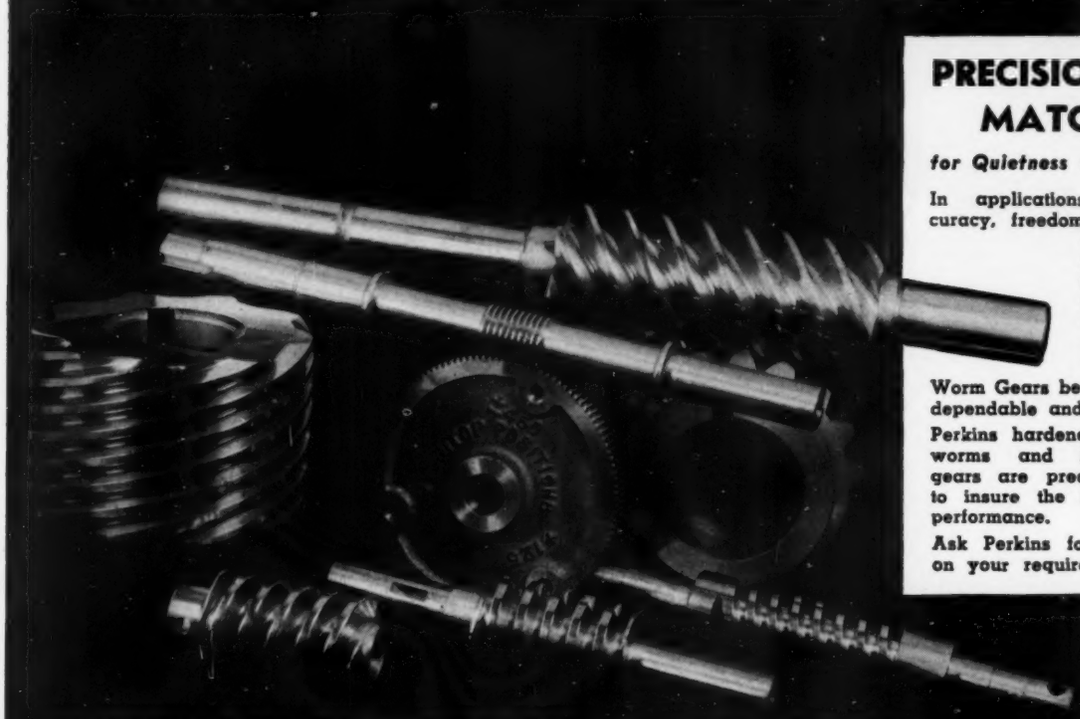


Hanson - Whitney 8 x 16" Semi-Automatic Thread Milling Machine.

The HANSON WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.

PERKINS *Custom Cut* WORMS



PRECISION MATCHED---

for Quietness and accuracy

In applications where accuracy, freedom from service costs and smooth, quiet operation are important, it will pay you to use Perkins Worms and Worm Gears because they are dependable and economical.

Perkins hardened and ground worms and bronze worm gears are precision matched to insure the finest kind of performance.

Ask Perkins for an estimate on your requirements.

PERKINS MACHINE & GEAR CO. 110 CIRCUIT AVENUE SPRINGFIELD, MASS.

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SPURS—SPIRALS—BEVELS—WORM GEARING

(14 to 96 D. P.)

With considerable experience and exceptional facilities for the manufacture of high precision Small Gears, our manufacturing capacity is now heavily burdened with National Defense work, and we naturally feel pardonable pride in the importance and quality of our contributions to the Program.

While this very essential work takes precedence, we are keenly conscious of our *duty* to *established* customers; their needs must command our continued earnest efforts. Under such circumstances, we hope new inquirers will understand our inability to give their wants the consideration they would ordinarily receive.

Gear Specialties

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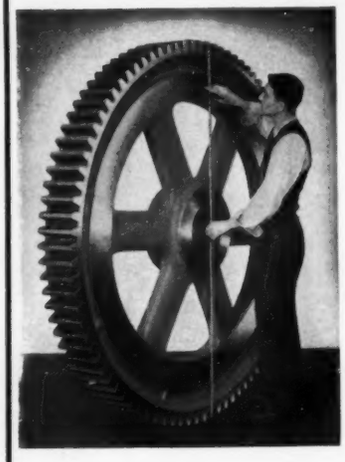


GEARS THAT WILL *Measure Up!*

Stahl gears will measure up to every requirement you demand — in material, accuracy, workmanship and performance. In price, too, you'll find Stahl assures satisfaction because we're "geared" to produce gears to any specifications in any quantity, economically. So outline your requirements and let us quote. You can depend on Stahl for a prompt estimate and fast service.

THE STAHL GEAR & MACHINE CO.

3901 Hamilton Ave. **Cleveland, Ohio**

FARREL DRIVES for VICTORY UNDER the NAVY "E"

The Navy "E" lapel emblem awarded to all Farrel-Birmingham employees

In recognition of *Excellence* in the production of Farrel Gear Drives for Navy ships, our three plants at Ansonia and Derby, Conn., and Buffalo, N. Y., have been awarded the "E," traditional Navy symbol for a job "Well Done."

In all our plants resourceful engineering, skilled workmanship and modern facilities are being combined in a sustained drive not only to meet but continuously to exceed the Navy's expectations in production performance, so that we may more than merit this distinctive honor and keep the "E" burgee flying over our plants.

Every member of our organization is proud of the honor conferred upon him and all dedicate their individual and cooperative effort to the utmost production of war equipment needed for America's Victory Drive.

When victory is won this same combination of plant and personnel will again be able to devote its facilities and skill to building equipment for the advancement and improvement of manufacturing processes for American peacetime industry.

FARREL

FARREL-BIRMINGHAM COMPANY, INC.

344 VULCAN ST., BUFFALO, N. Y.

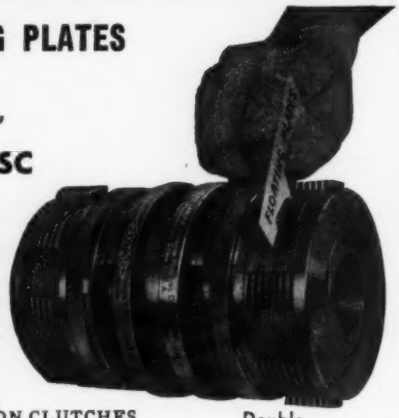
Plants: Ansonia and Derby, Conn.; Buffalo, N. Y.

THE JOHNSON FRICTION CLUTCH-

HAS FLOATING PLATES

THE NEW "MAXITORQ" MULTIPLE DISC DESIGN.

...for better clutch performance under ANY CONDITIONS



Double "Floating Plates" in neutral

More than thirty years of successful application of JOHNSON FRICTION CLUTCHES to practically all power transmission demands is behind every recommendation made by our Engineering Department.

You can, therefore, depend on better clutch performance regardless of the severity of operating conditions, when you bring your clutch problems to JOHNSON Engineers for study.

Among the operating features which contribute to better performance are sensitive starting, safety, cleanliness, quietness, efficiency and long life.

You incur no obligation in asking us to show specifically how you can improve power transmission on your machines. Just give us the details of your problem.

Write for Multi-Disc Clutch Catalog No. 72 or Consult "Sweet's" or "Thomas' Reg."

Single

THE CARLYLE JOHNSON MACHINE CO.

"When your specifications call for special gears — Spur — Bevel — Mitres — Helical — Worms and Worm Gears —Reduction Units—Why not try GRANT.

You will find GRANT service meeting all requirements on both stock and special gears."

GRANT GEAR WORKS BOSTON

GEAR CUTTING MACHINES

New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.

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FINE GEARS of All Types and Sizes

Spur Gears—½ in. to 30 ft. in diameter
Bevel Gears—½ in. to 13 ft. in diameter
Spiral Gears—½ in. to 10 ft. diameter
Worm gears in any practical size

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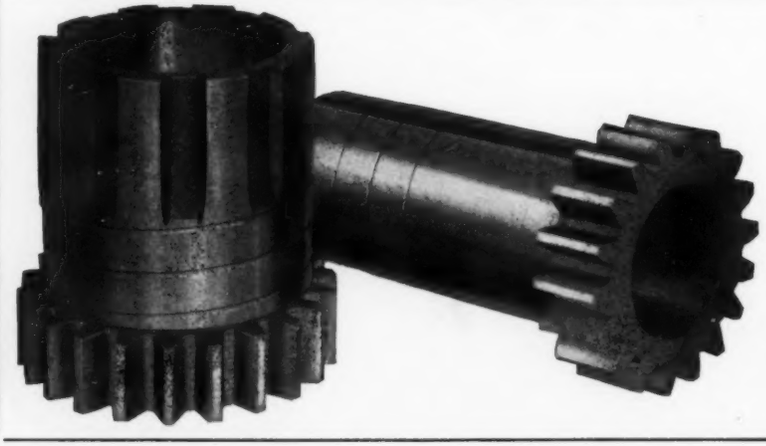
GANSCHOW GEARS

FOR SIXTY YEARS

Spur – SPEED REDUCERS – Worm

ALL TYPES OF CUT GEARS

GANSCHOW GEAR CO., 18 N. Morgan St., Chicago



ADAMS GEARS

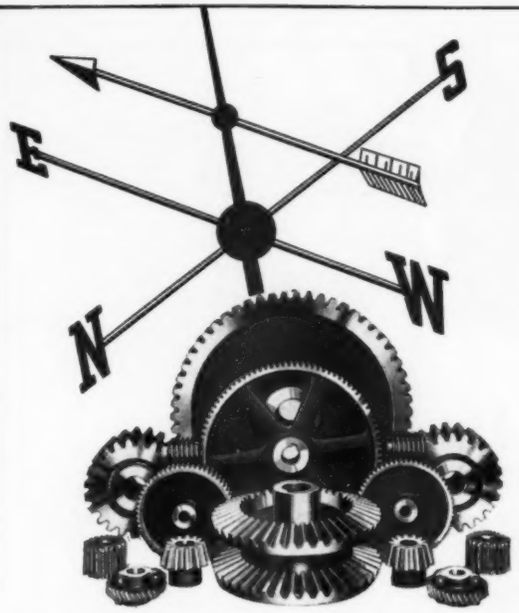
SPUR — HELICAL — WORM
BEVEL — MITER — RACKS

Splined Shafts A Specialty

THE ADAMS COMPANY

Est. 1883

1942 Bridge St. Dubuque, Iowa



North... East... South... West... Cincinnati Gears are serving industry faithfully and with quiet efficiency.

Cincinnati Gears are made to your exact specifications. No "tight spots" in your production problem if you specify Cincinnati Gears.

Suggestions from our gear counsel are available to you.

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
1825 Reading Road • Cincinnati, Ohio

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All WATERBURY STEEL BALLS are of uniform hardness which extends to the center of each ball. Made of high carbon chrome alloy steel highly finished.

HIGH CARBON CHROME ALLOY STEEL, BRONZE, MONEL METAL, STAINLESS STEEL BALLS, STANDARD OR SPECIAL SIZES. WRITE FOR COMPLETE INFORMATION.

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THE WATERBURY STEEL BALL CO., INC.
Poughkeepsie, New York
Factory: Waterbury, Conn.

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PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
AND QUANTITIES
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GEARED FOR VICTORY
Bevel-Spur-Worm-Helical
THE TAYLOR MACHINE COMPANY
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"TAYLOR - MADE"

EACH GEAR A MASTER GEAR

and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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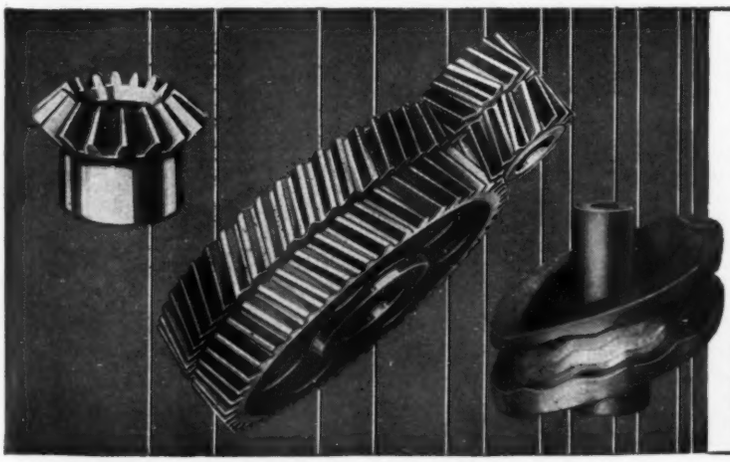

GET YOUR QUOTATION *from* "HARTFORD"

GEARS of every description cut to order
GEAR, CAM and THREAD grinding
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Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.

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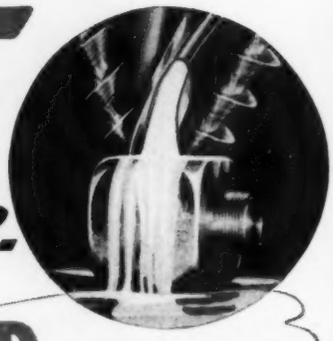
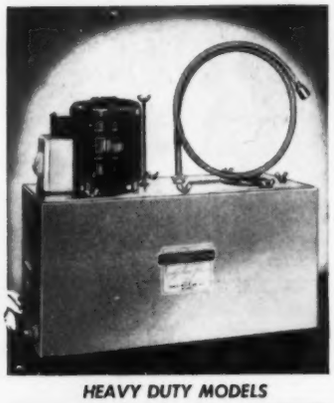
SAVE CUTTING TOOLS-



Install GRAY Portable COOLANT SYSTEMS



HEAVY DUTY MODELS

STANDARD DUTY MODELS

COOLANTS and cutting oils . . . properly applied . . . will greatly improve machine tool production. Proper coolants permit higher cutting speeds . . . more pieces per hour. Improvement in tool life reduces loss of time for tool changes . . . adding many hours of productive time. SAVE CUTTING TOOLS . . . INCREASE PRODUCTION 25% to 100%.

FOR LARGE TOOL EFFICIENCY IN SMALL TOOL EQUIPMENT

GRAY Portable Coolant Systems help prolong the life of hard-to-get machine tools. Their portability and flexibility of design, make installation a quick and easy matter. They provide . . . by controlled flow . . . the exact amount of coolant, right where it is needed, with ample pressure to reach the vital spots. Modernize your machine tools this economical way.

COMPLETE COOLANT SYSTEMS

GRAY Precision-Built Pumps, "Flo-Bac" Coolant Pans, Valves, Brackets and Fittings, used together, provide a highly efficient coolant system that can be installed in a few minutes on your present machine tool equipment. The complete line of pumps include high pressure models capable of handling ten or more applications. "Flo-Bac" Pans and Coolant Fittings are carried in stock for many machines or made to your requirements. INVESTIGATE TODAY!

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3 Standard Models. 3 Heavy Duty Models. From 50 G. P. H. to 165 G. P. H. high pressure capacities.
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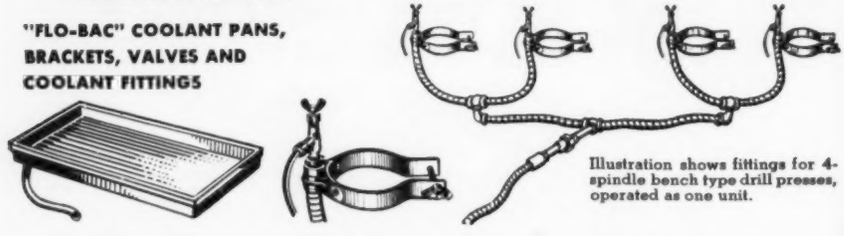

Illustration shows fittings for 4-spindle bench type drill presses, operated as one unit.

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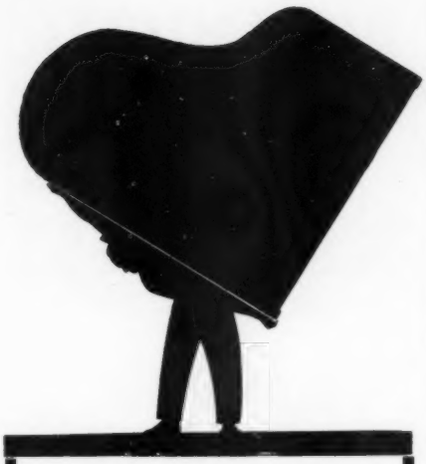

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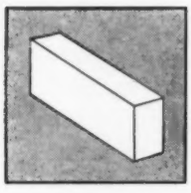

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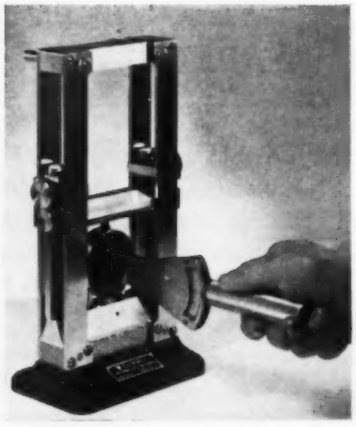

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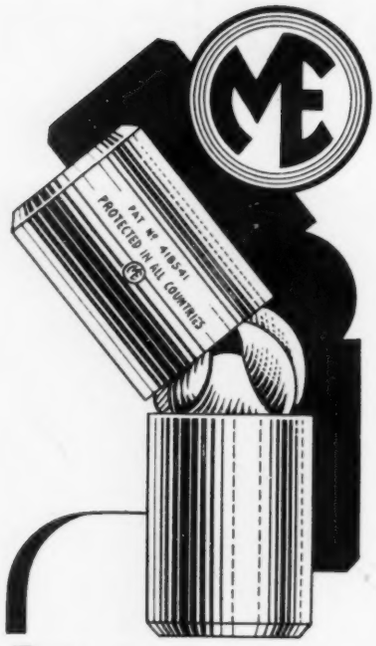

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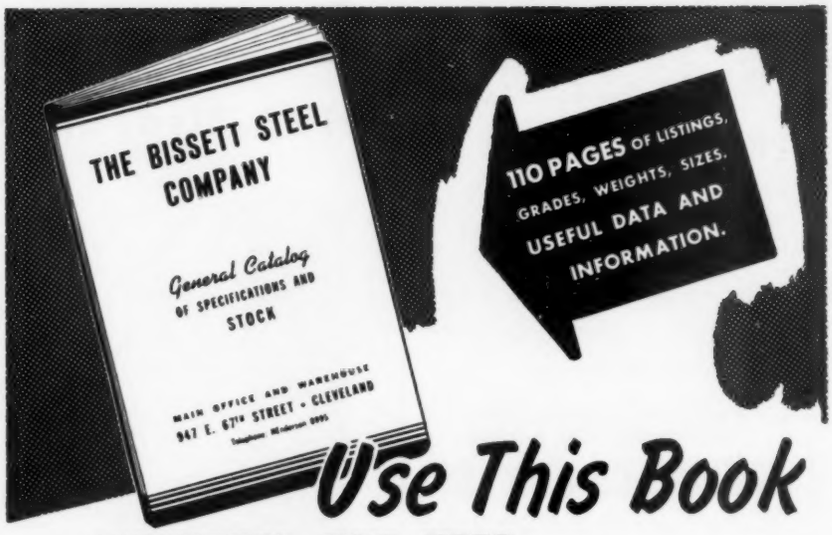
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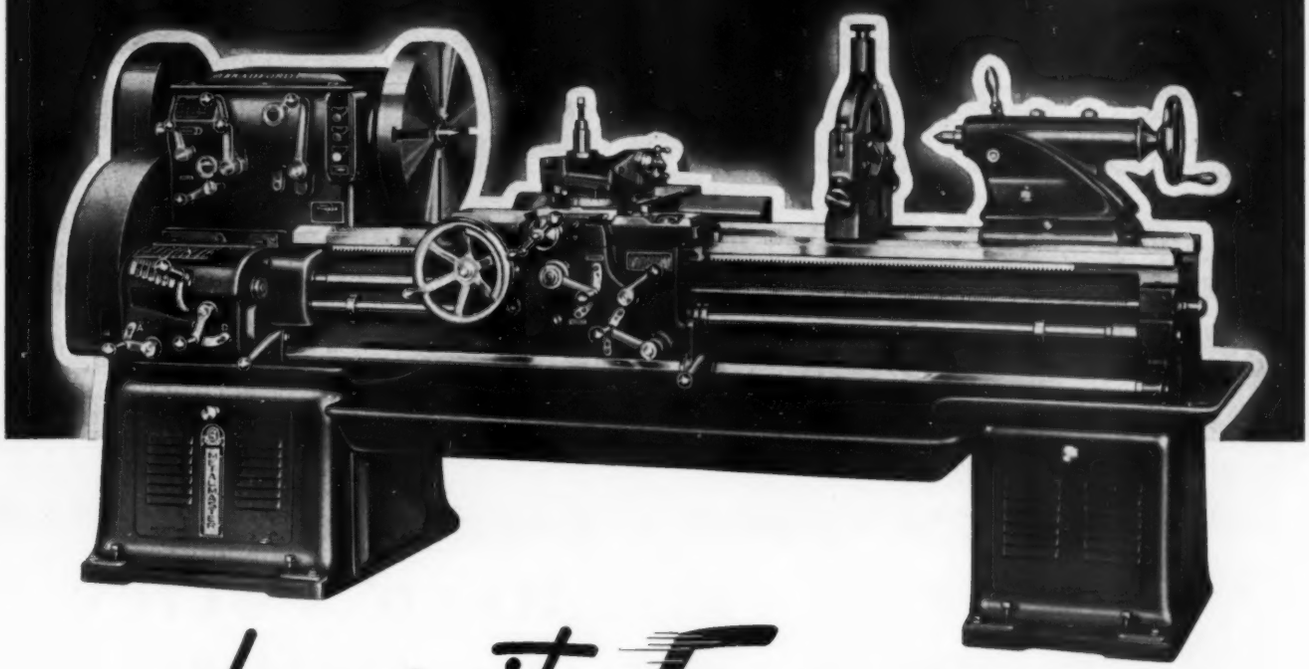

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These modern tool holders—especially adapted for use in precision production—can be depended on to prevent chatter and protect against broken cutters and damaged work.

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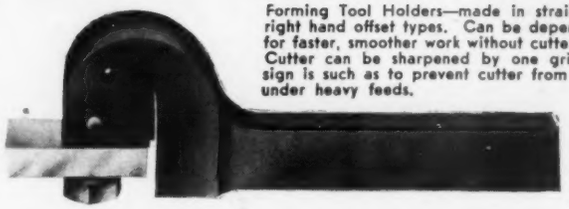

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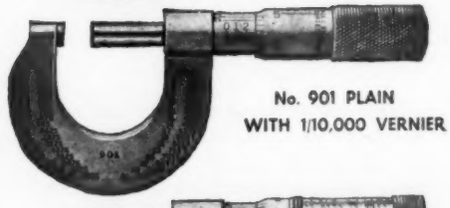

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Flexible Back Metal Band Saws

How to obtain greater efficiency and make saws last longer.

FAILURE	CAUSE	CORRECTION
Stripping teeth	Tooth spacing too coarse.	Use recommended spacing.
	Starting cut at extremely thin section of material or on a corner.	Start cut where several teeth will contact material at same time.
Premature wear and loss of set	Speed too fast.	Reduce—see recommendations.
	Rubbing in guides.	Adjust so that teeth project beyond guides—also so that teeth project over edge of wheels.
	Riding on wheels.	
Breaking	Twisting in the cut.	If irregular cutting, use proper width saw for radius.
	Misalignment of guides.	Adjust so that top and bottom guides are in alignment.
	Guides set too far apart, allow band to twist.	Always adjust guides as close as possible to piece being cut.
	Insufficient tension.	Adjust tension to approximately 300 lbs. per inch of saw width.
	Allowing band to remain in tension when not in use.	Remove saw from machine or release tension. Where extreme differences of temperature occur, this practice will prevent breakage.
Cutting out of line	Misalignment of guides.	Adjustment should be made.
	Spacing of guides.	Set as close as possible.
	Set worn on one side due to contact with wheels or guides.	Adjust so that teeth project beyond guides—also so that teeth project over edge of wheels.
	Feed too heavy.	Reduce feed or use coarser tooth saw.

(CONTINUED ON OTHER SIDE)

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This assures you high uniformity and speed. A large quantity of parts can be turned out in a hurry, making these furnaces ideal for large-scale production of highly uniform work.

SCALE-FREE WORK

All four can be used with protective atmosphere to prevent oxidation and decarburization. The work emerges bright and clean. Time and labor are not wasted in rejections and inspections.

LITTLE OPERATION LABOR

Very little labor is required to operate the furnaces. After loading the work on the conveyors, automatic controls put it through the proper time, atmosphere, and temperature periods. No attention is required until the work is discharged.

HIGH HEATING EFFICIENCY

Long-life heating units mechanical parts, assure continuity of service and low maintenance cost. Heat losses are low, too. As a result, the furnaces give you a high heating efficiency. Not only that, but confinement of the heat within the furnace makes for comfortable working conditions.

MESH BELT

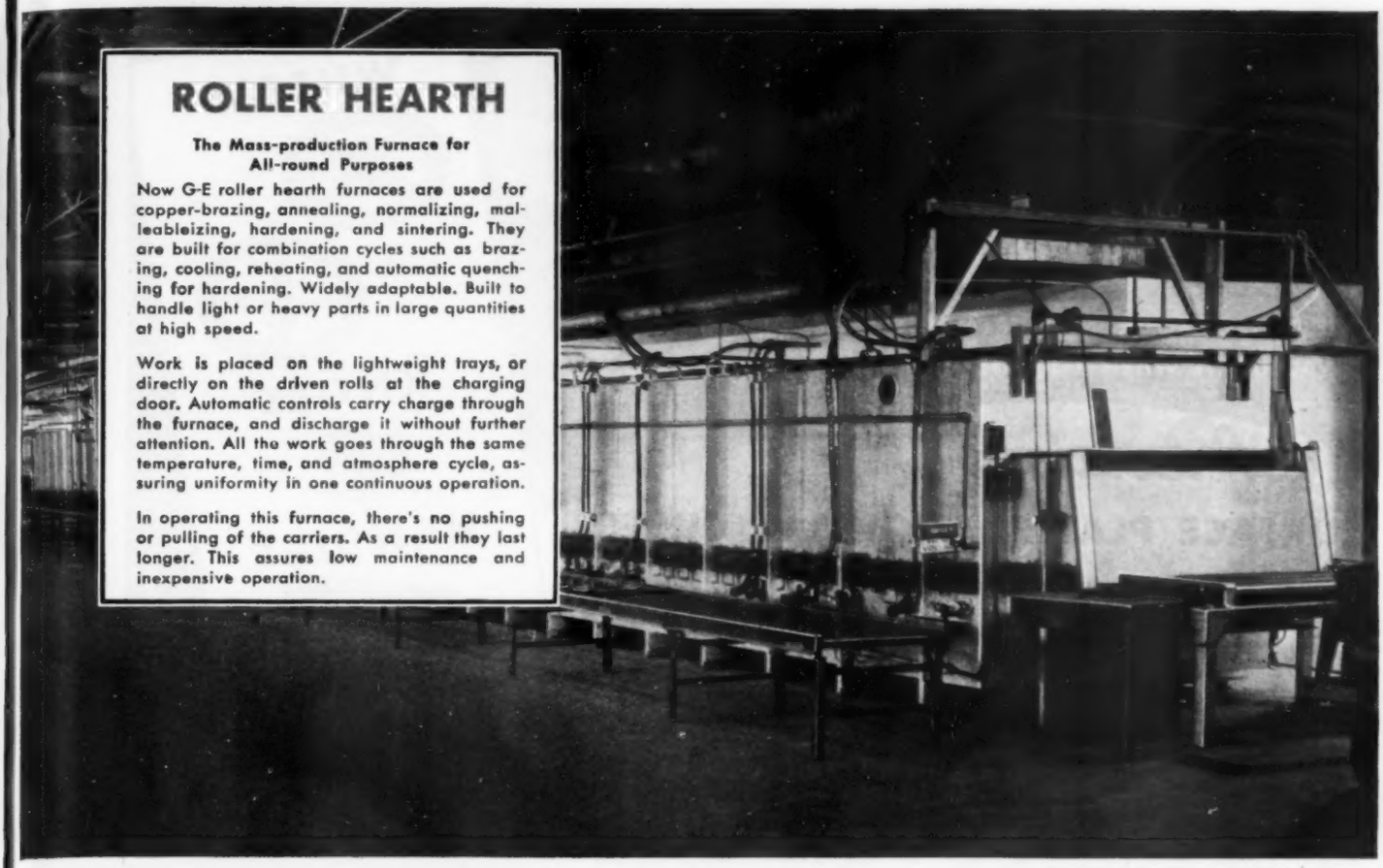
The Furnace for Lightweight Parts

This furnace is for copper-brazing, bright-annealing, normalizing, drawing, or sintering lightweight parts. No trays are needed. Just load the parts on a belt, and one continuous operation will bring them out bright and uniform. No additional handling required. Belt travels at a constant set speed, putting each part through the same time cycle, same temperature, and same atmosphere—assures high uniformity and minimum of attention.

CONVEYOR HARDENING

The Furnace for Fast Heat-treating

Here's the conveyor furnace for scale-free hardening without decarburization. Just place the work on the belt, and automatic controls put it through the proper time and temperature cycle—one continuous operation. Once loaded, parts require no further attention until discharged automatically from the quenching tank. Rejects are eliminated. Work is bright, clean, and uniform. Heat losses are low, too, since conveyors are confined within the furnace.



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The Mass-production Furnace for All-round Purposes

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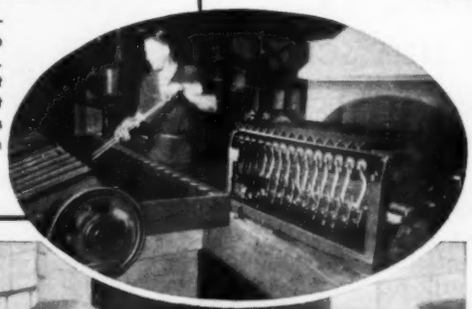
Work is placed on the lightweight trays, or directly on the driven rolls at the charging door. Automatic controls carry charge through the furnace, and discharge it without further attention. All the work goes through the same temperature, time, and atmosphere cycle, assuring uniformity in one continuous operation.

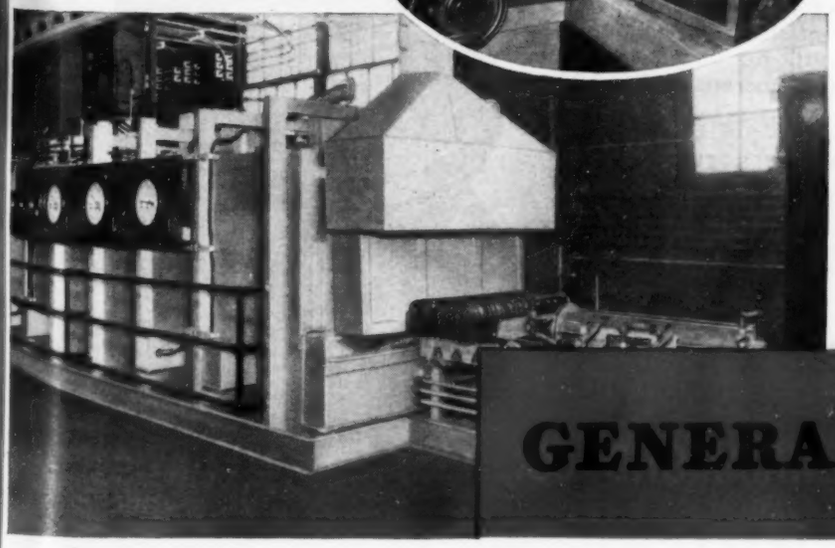
In operating this furnace, there's no pushing or pulling of the carriers. As a result they last longer. This assures low maintenance and inexpensive operation.

PUSHER TYPE

Built in two types, these furnaces are recommended for both light and heavy work. The first type is a furnace with V troughs. Here the work is put through by pushing one part against others. These furnaces are used for heat-treating shells and similar work.

The second type is for heat-treating parts that must be carried through on trays. The trays go through at predetermined rates of heat and speed in one continuous operation, assuring high uniformity.





HERE'S WHY

A Continuous-type Furnace Assures Uniformity and Fast Work

One continuous and complete operation puts all parts through the same time cycle, same temperature, and same atmosphere. This assures uniformity of all the parts. Work is done fast, too. No handling of the parts is required from the time they are put into the furnace until they are discharged.

G.E.'s continuous furnaces are built to do your mass-production heat-treating uniformly and fast and to stay on the job. For more information on the kind of furnace you should use for your work, consult one of our local heating specialists. Call him today, or write General Electric Co., Schenectady, N. Y.

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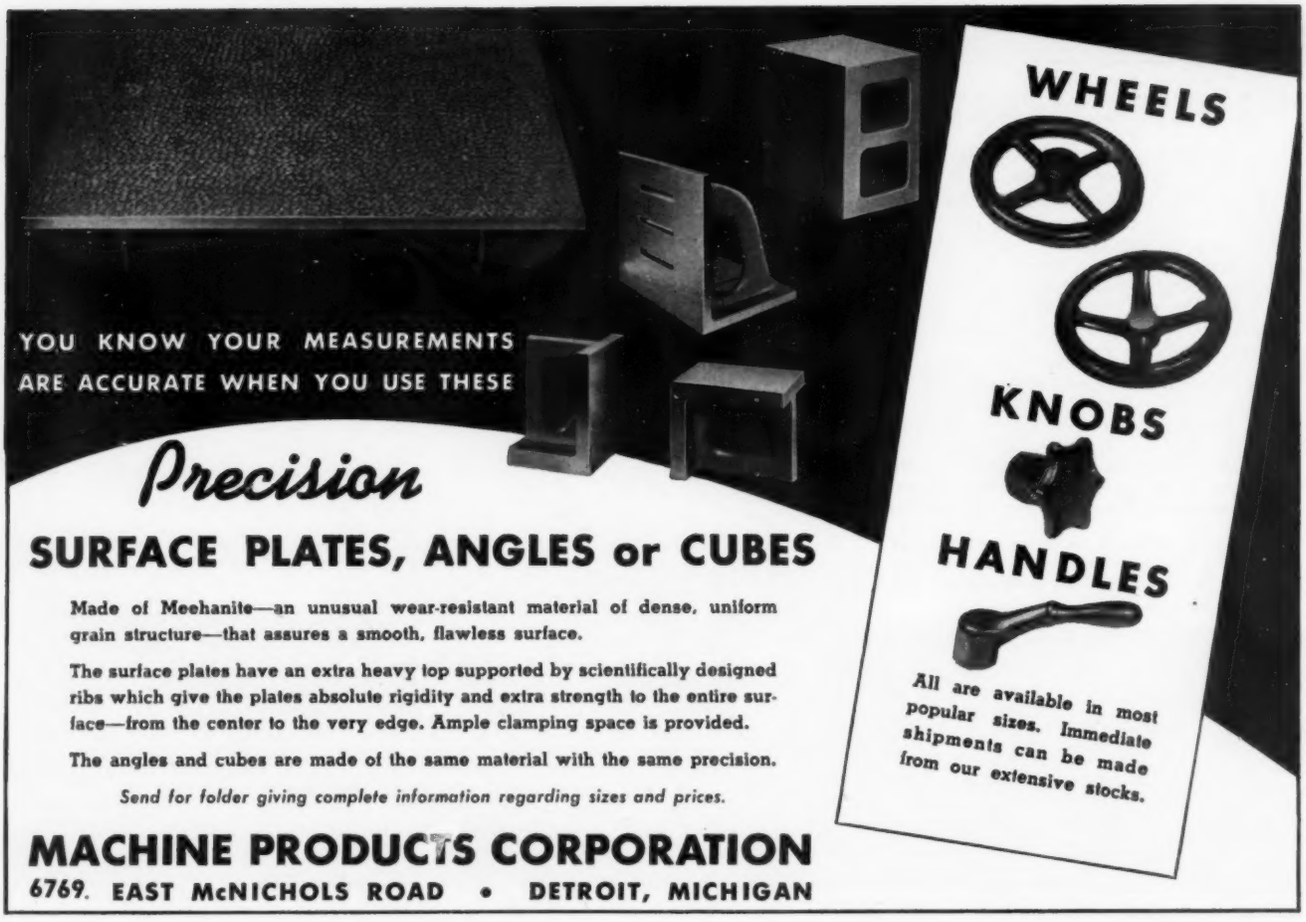

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Ross-Meehan Foundries

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Greenlee Foundry Company

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Cincinnati Grinders Incorporated

Cincinnati, Ohio
The Cincinnati Milling Machine Co.

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Flint, Mich.
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Irvington, N. J.
Barnett Foundry & Machine Co.

Los Angeles, Calif.
Kinney Iron Works

Milwaukee, Wis.
Koehring Company

Mt. Vernon, O., Grove City, Pa.
Cooper-Bessemer Corporation

New York, N. Y.
The American Brake Shoe & Foundry Co.

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Vulcan Foundry Company

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Banner Iron Works

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Meehanite BRIDGES THE GAP!

FROM 9 MONTHS BEHIND SCHEDULE

TO 2½ MONTHS AHEAD OF SCHEDULE

Meehanite castings for work spindle and spindle gear, made by Farrel-Birmingham Co., Inc.

Almost a year has been gained in delivery of special lathes used for machining British shells through a change to Meehanite castings for several important parts! Due to difficulty in securing materials it appeared that deliveries of these vitally needed tools would be 9 months behind schedule. But by specifying Meehanite, deliveries were actually made 2½ months *ahead* of schedule! Performance of these lathes in service has amply proved the forecast that Meehanite would do the service job required.

Meehanite castings offer many advantages to equipment and machinery manufacturers. Combining the best properties of cast iron and steel, this metallurgically controlled cast metal provides high strength, good wearing qualities, and adaptability to heat-treatment and flame-hardening. Design characteristics are reliable and such engineering properties as high damping capacity, good machinability, and maintained dimensional accuracy are provided. Let the nearest Meehanite foundry show you how to use this modern cast metal to your advantage and profit!

MEEHANITE RESEARCH INSTITUTE · 311 ROSS STREET · PITTSBURGH, PA.

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SEND FOR BOOKLET

Write for Engineering Bulletin No. 9—"Meehanite, the Metal for Machine Tool Castings."

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IT DOES THE JOB

on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Brown & Sharpe and Cleveland Automatic Screw Machines.

TURNER UNI-DRIVE

Motorizes Machine Tools

The old way is too slow today. More speed... greater production... you must have them to keep apace! Enlist the aid of TURNER UNI-DRIVES. They'll increase production like an extra shift... save time... speed up work... keep down power costs. They're doing it in scores of shops and plants. They'll do it in yours. TURNER UNI-DRIVE is the *successful* motor drive.

Easily and quickly installed. They do away with overhead counter shifts... no belts to shift. Increase the efficiency of machine and operator. Drive on large cone at all speeds. One trial will thoroughly convince you.

Right now — today... investigate TURNER UNI-DRIVE. See your dealer, or write or wire us for full information.

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"Speeding Production is a cinch with our new UNI-DRIVES"

4

"War-Made Friends"

HACK SAW BLADE USERS and INGERSOLL

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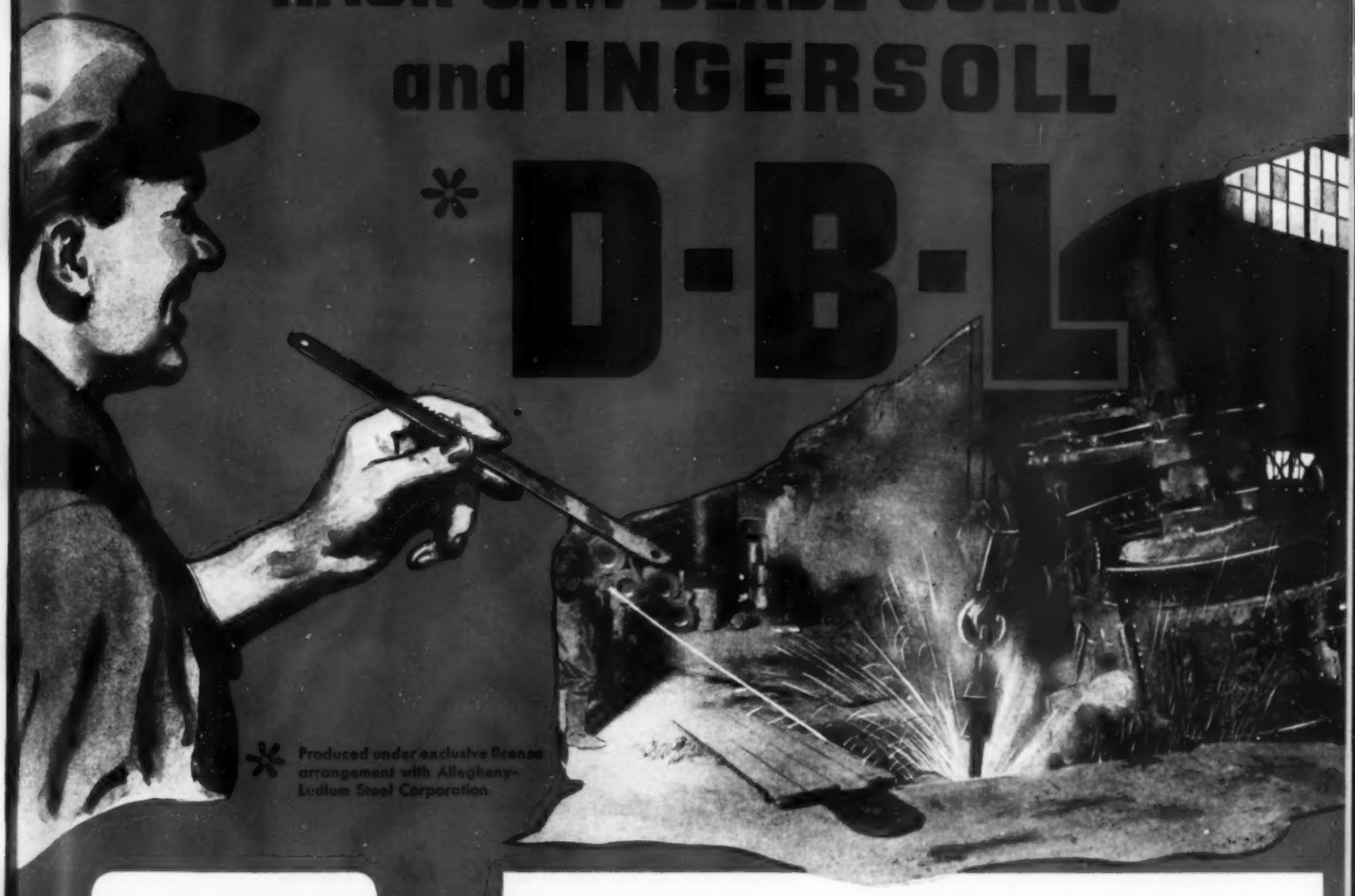

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- IngAclad (Stainless-Clad Steel)
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In a great many plants Ingersoll D-B-L Steel has made warm friends of those who buy and use Hack Saw Blades . . . In some cases only the necessary conservation of vital alloys gave D-B-L a reluctant first trial . . . Today in these same shops D-B-L is enthusiastically accepted and approved because it is so high in impact resistance, provides so tough a cutting edge, and is so relatively free from decarburization.

These advantages, plus *lower cost*, have won for Ingersoll D-B-L Hack Saw Steel a permanent place along with Ingersoll 18-4-1 and Molybdenum which were pre-war favorites.

Specify Ingersoll D-B-L Steel on orders for Hack Saw Blades

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BORG-WARNER CORPORATION
New Castle, Indiana
Plants: New Castle, Ind.; Chicago Ill.; Kalamazoo, Mich.

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To the MANUFACTURER with VISION for TOMORROW

Technical information regarding all types of SLEEVE BEARINGS such as Alloys, Lubrication, Design.

Facilities for complete manufacture of EVERY type of SLEEVE BEARING and BUSHING.

Research to determine the CORRECT answer to unusual bearing applications.

Service with capable field engineers located in TWENTY-TWO industrial centers.

Here is how JOHNSON BRONZE *can help you* TODAY

◆ War has interrupted normal business but it hasn't stopped thinking . . . and planning for tomorrow. Leading manufacturers in every line of products are now seeking new ways to improve . . . to cut costs . . . to increase performance. All this is possible with the *right* type of bearings.

Why not ask a Johnson engineer to review your bearing applications? Chances are ten to one that he can make a worthwhile suggestion . . . a recommendation backed by more than 30 years exclusive bearing experience. As we make *ALL* types of sleeve bearings, we hold no prejudice for any one kind. Your inquiry carries no obligation.

JOHNSON BRONZE COMPANY

Sleeve BEARING HEADQUARTERS

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AIR HAMMER *Pistons*

Air hammer piston on left is made of Graph-Tung Steel. After 5,280 hours, it showed little sign of wear. The hammer on the right, made of ordinary tool steel, failed after 546 hours.

Several years ago we made 25 air hammer pistons of Graph-Tung Steel. When one of these, operating at 2,500 strokes per minute, achieved a record of 5,280 hours of service we were so well pleased that we ran an advertisement telling all about it.

We thought then and we still think our enthusiasm was well founded because companion pistons made of standard tool steels stood up under the same service conditions a maximum of 546 hours.

Here's the sequel to this story. These 25 Graph-Tung Steel pistons averaged 7,680 hours of service life.

The less expensive Graph-Mo Steel is now being widely used with similar results.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

You SAVE steel and SPEED up production with Graphitic Steels. Long service and high speeds are essential to VICTORY. They'll be essential in post-war competition; too.

Keep Your War Production, Too, "On The Beam" By Doing All Your Degreasing Operations The Time-Saving Oakite Way!

Aircraft plants form a precision-minded industry. They first determine the fastest, most effective way each degreasing, cleaning or other essential production operation should be performed . . . and, thereafter, that is the standard and approved procedure followed for handling the work. Production is kept right "on the beam" as war-time deliveries require. That is why you will find leading aircraft and accessory plants making bombers, fighters, engines, magnetos, spark plugs, carburetors, flight instruments and communication equipment are using SAFE, fast-working Oakite materials for these 10 important jobs:

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If you are now facing NEW or UNUSUAL degreasing problems on war work, tell us . . . we can help! ALL our facilities, summarized in panel at right, are FREELY available, without cost or obligation, to ANY concern whether or not it is now using Oakite materials. Your inquiries invited and promptly answered . . . write today!

OAKITE WAR-TIME SERVICE FACILITIES AVAILABLE TO YOU WITHOUT COST OR OBLIGATION

Nation-Wide Field Staff: To render competent, personal service, day or night, on any cleaning operation you want speeded up.

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Manuals, Booklets, Data Sheets: Reference literature to help you handle all your cleaning work on a consistently fast, thorough, safe, low-cost basis.

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OAKITE Specialized **CLEANING**
MATERIALS...METHODS...SERVICE — FOR EVERY CLEANING REQUIREMENT

In times like these, it's very important to *Select the* RIGHT MOTOR for every application—

WAGNER motors may be broadly divided into three general classes: polyphase, single-phase, and direct-current. The following outline shows the various subdivisions and the Wagner type letters which apply to them.

1. Polyphase
A. Squirrel-Cage Rotor
1. Low resistance Type RP-1
2. High reactance Type RP-5
3. High resistance Type RP-6, RP-7

B. Wound Rotor
1. Low resistance Type RS
2. High resistance Type RT
3. Synchronous Type RN

2. Single-Phase
A. Wound Rotor
1. Repulsion start Type RA
2. Repulsion-induction Type RG

B. Squirrel-Cage Rotor
1. Capacitor-start Type RK
2. Split-Phase-start Type RB

3. Direct-Current
A. Wound Rotor
1. Compound-Wound Type RD

Polyphase Squirrel-Cage Low-Resistance (1/6 to 400-hp)

Because of its simplicity, rugged construction, and low cost the RP-1 motor is the most popular type used in industrial plants. It has sufficient starting-torque for operating machine tools, fans and blowers, centrifugal pumps, some types of compressors, and many other kinds of machinery.

Polyphase Squirrel-Cage High-Reactance (1-1/2 to 125-hp)

Some applications require motors of higher starting-torque than obtainable in RP-1 motors. Typical examples are crushers, plunger pumps, belt conveyors starting under load, large air compressors, large refrigerating machinery, mixers, etc. For such applications Wagner builds a high starting-torque motor with high-reactance rotor, known as type RP-5.

Polyphase Squirrel-Cage High-Resistance (1/2 to 150-hp)

The motors discussed thus far are not suitable for operating machines having heavy flywheels because these motors will not permit the flywheels to deliver enough of their stored energy during the punching or drawing operation. For these applications Wagner builds RP-6 motors with high-resistance rotors. During the working part of the cycle, the motor speed drops considerably and allows the flywheel to do its work. High-resistance rotors are also used in RP-7 (1 to 50-hp) elevator motors, which are used on low-speed elevators, hoists, dumb waiters, etc.

Polyphase Wound-Rotor Low-Resistance (1 to 250-hp)

There are two reasons for the existence and application of motors of the Wagner type RS. First, since the rotor winding is connected to slip-rings making it easy to connect a high external resistance in the rotor circuit, it is possible to obtain extremely low starting-currents without impairing the running performance. Second, by introducing resistance in the rotor circuit of an RS motor it is possible to obtain speeds from 50 to 97% of synchronous speed. This method of speed control is satisfactory when the load is constant. For obtaining different speeds on applications where the load varies, Wagner recommends the use of polyphase squirrel-cage multi-speed motors, type MRP, which may be obtained with two, three, or four speeds.

Polyphase Wound-Rotor High-Resistance (40 to 100-hp)

The air-conditioning industry sometimes requires motors which must have higher starting-torques and lower starting-currents than can be obtained in good squirrel-cage motors. For such applications the Wagner RT motor was developed. The characteristics of unusually high starting-torque and exceptionally low starting-current are accomplished by using a high-resistance secondary winding which is permanently short-circuited.

Polyphase Wound-Rotor Synchronous (7-1/2 to 200-hp)

Wagner Synchronous "Fynn-Weichsel" motors, type RN, differ from conventional synchronous motors in that they have starting characteristics like RS motors, do not have separate exciters, and have simple starting devices. The RN motor is the ideal motor to install where power factor needs correction because it not only improves the power factor but also handles the toughest job to be found.

Single-Phase Wound-Rotor Repulsion-Start (1/8 to 15-hp)

For single-phase circuits there is no better motor than the Wagner RA repulsion-start induction motor, which starts as a repulsion motor with high starting-torque and low starting-current, and, upon approaching operating speed, is automatically converted into an induction motor. With few exceptions, if single-phase current is involved, the RA motor is the logical choice.

Single-Phase Wound-Rotor Repulsion-Induction (1 to 5-hp)

Filling-station compressors are often operated in cold locations under weather conditions which congeal the oil in the compressor crankcase and may increase the load until it is double its normal value. For such applications Wagner produced the RG motor which is a brush-riding machine with a squirrel-cage to limit the idle speed. This type of motor will carry any load which it can start and is ideal for filling-station compressor applications.

Single-Phase Squirrel-Cage-Rotor Capacitor-Start (1/6 to 1-hp)

In order to meet a competitive situation Wagner builds the RK motor, which is a capacitor-start induction machine.

Single-Phase Squirrel-Cage-Rotor Split-Phase-Start (1/20 to 1/3-hp)

The cheapest type of single-phase motor is the RB split-phase machine. It is recommended for applications where the starting duty is light and the period of acceleration is short. The RB-5 (1/6, 1/4 and 1/3-hp) is a special service motor intended for washing machines, mangles, etc., which operate only for a short period of time at infrequent intervals. The RB-5 motor should not be used on jobs which operate continuously.

Direct-Current Wound-Rotor Compound-Wound (1/6 to 3-hp)

Wagner also builds direct-current type RD motors, which are still required in some locations.

M42-9

WAGNER ELECTRIC CORPORATION
6400 PLYMOUTH AVE. • • ST. LOUIS, MO., U. S. A.

BRANCHES IN TWENTY-FIVE PRINCIPAL CITIES

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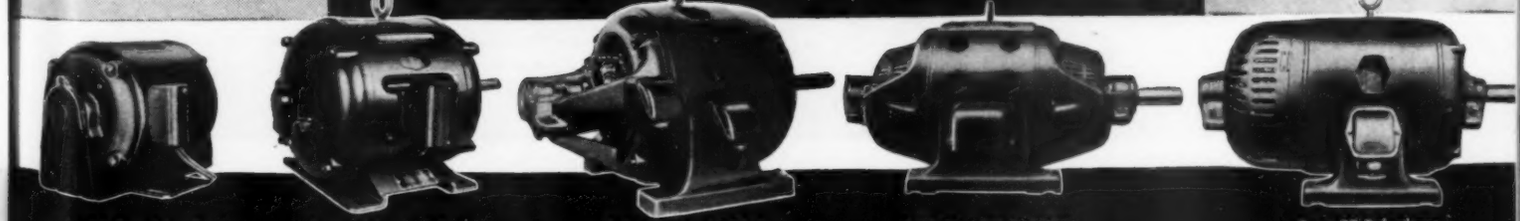
• MOTORS •

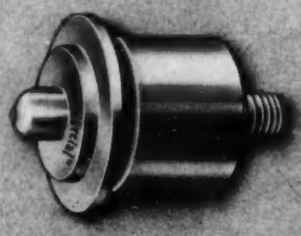
SEND FOR FREE BULLETINS DESCRIBING WAGNER MOTORS



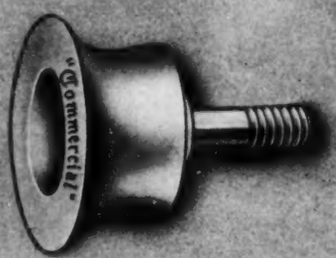
Type RA Repulsion-Start-Induction Single-Phase Motor | Type RP Squirrel-Cage Polyphase Motor | Type RS Wound-Rotor Slip-Ring Motor | Type RN Fynn-Weichsel Synchronous Motor | Type RT Polyphase Induction Motor

MOTORS • TRANSFORMERS • FANS • BRAKES

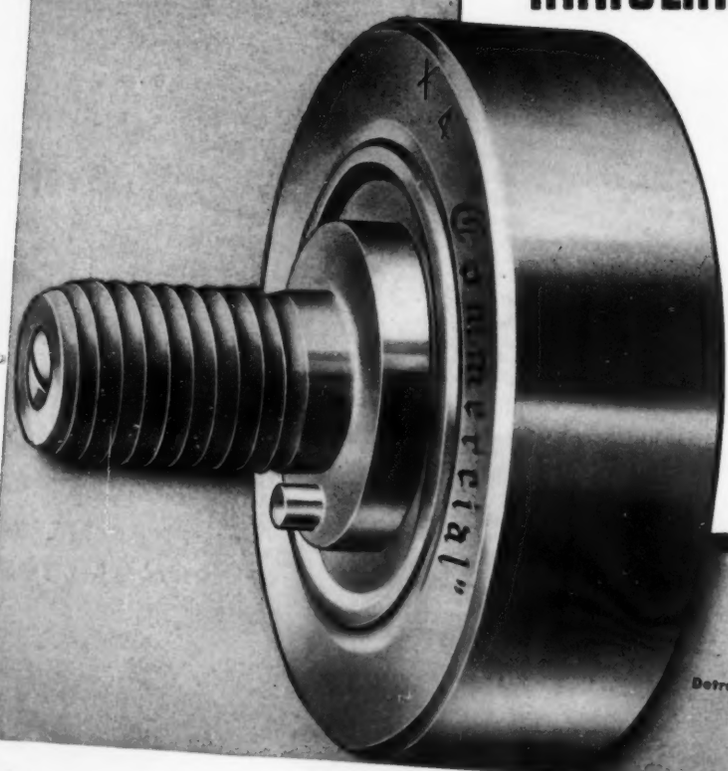
Bearings Made to Your Specifications



OUR plant is geared to make ball bearings of almost every type and size—to your design and specification, or designed to meet your needs. We illustrate some Schatz "Commercial" Ball Bearings used in coal conveyors, textile winding machines, typewriter desks, etc. Our specialty is the most economical bearing that will perform satisfactorily.



SCHATZ "Commercial" ANNULAR BALL BEARINGS



For the smaller manufacturer, many standard types and sizes of "Commercial" Ball Bearings are available. They are used in hundreds of different industries. We can be of service—whether you need a few, or a great many units. Write for catalog.

THE SCHATZ MANUFACTURING CO.
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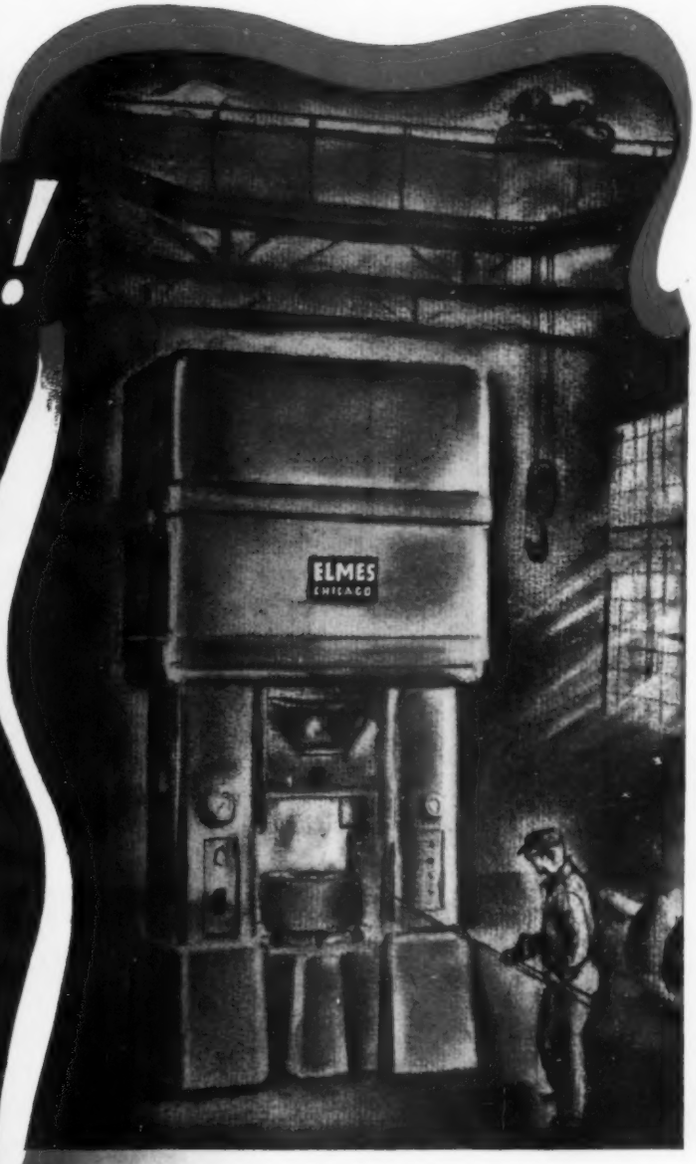
WINNING TWO WARS AT ONCE!



• American aerial bombs are bursting on a score of Freedom's battlefields. And hot off the presses are coming more and more shells, cartridge cases and parts for planes, tanks, guns and ships.

• Tough veteran fighters on the production line are Elmes hydraulic presses . . . performing all kinds of forging, forming and pressing operations with speed and accuracy. That's the Elmes' role in the war on tyranny. But there's another war . . . the ceaseless war on Production Costs. Here, too, Elmes Hydraulic Presses, Accumulators, Pumps and other products have a grand record for low-cost performance. Built into every Elmes product is an unquenchable belief in quality and 91 years of practical *knowing how* to produce it.

• Any time is a good time to discuss production problems with Elmes engineers. Now, for instance.

CHARLES F. ELMES ENGINEERING WORKS
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Since 1851
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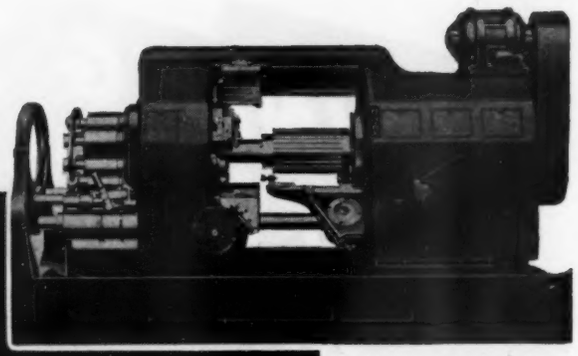

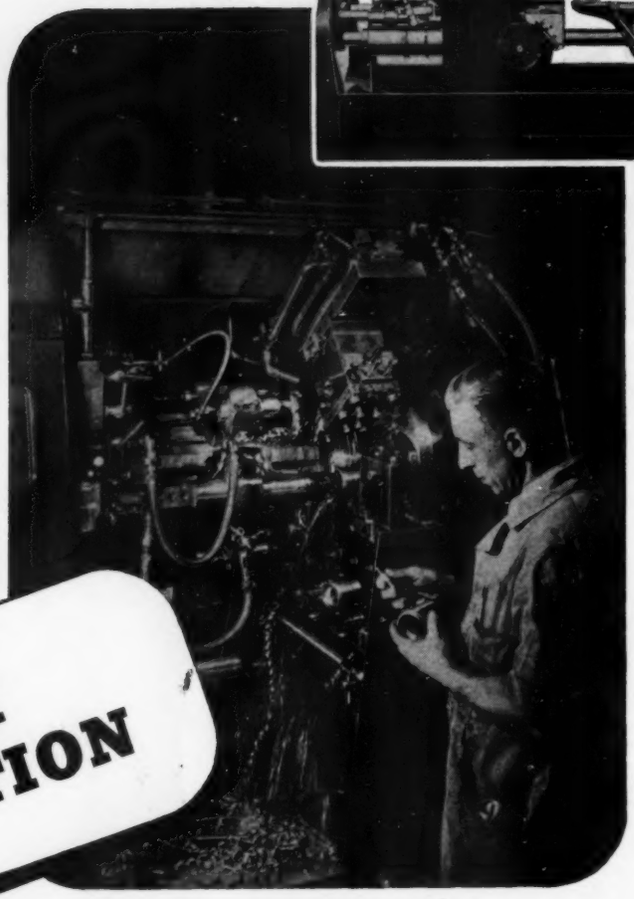

●2¼" Acme-Gridley Bar Automatic built by National Acme Co.

FOR PEAK PRODUCTION

IN spite of war production shifting into high gear, manufacturers are *maintaining extreme accuracy* on their lathes with the SKF Spindle Mounting. SKF's assure:

1. *Continuous peak production from heavy cuts and high speeds.*
2. *Freedom from chatter.*
3. *Maintained accuracy.*
4. *Long life.*

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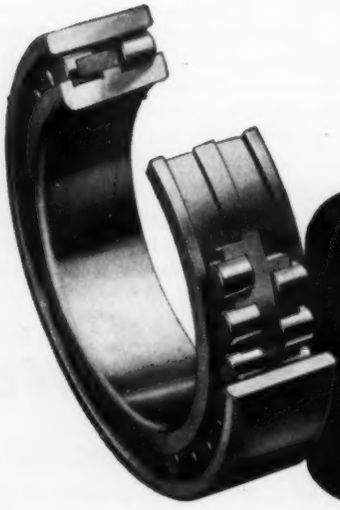
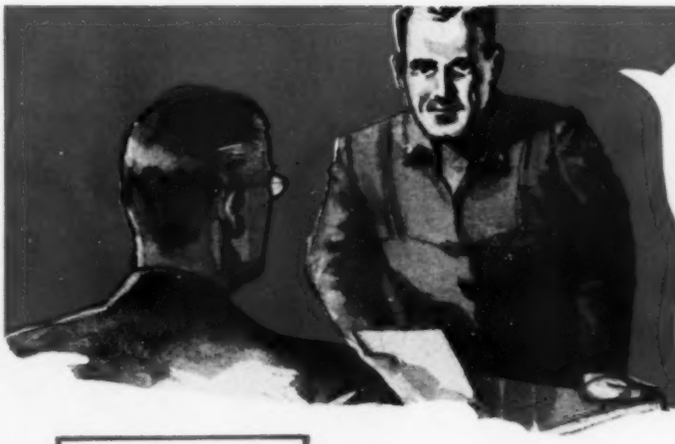


SKF
BALL AND ROLLER
BEARINGS



WE SAVED TIME AND MONEY BY MOTORIZING OUR MACHINES WITH DRIVE-ALL MOTORIZING UNITS!

HERE'S THE CASE HISTORY

"Our shop needed additional machines to handle extra subcontract work. We picked up a couple of older type machines from a large truck manufacturer. These machines had been driven from overhead shafting. We didn't have the time and didn't want to put up more old-style line shafting. Found DRIVE-ALL could take over the whole job of motorizing our machines. We got the entire motorizing equipment—sheaves, v-belts, brackets, motors and switches—all from DRIVE-ALL quickly on *one* order. Result: Time, money and trouble saved."

HERE'S THE DRIVE-ALL UNIT...

A selective speed motorizing unit that can be installed in approximately 2 hours. Available as Standard Unit, 1 to 5 h.p. and as Heavy Duty 5 to 10 h.p. Both with 3- or 4-speed gear boxes. The Drive-All installation cost in the above typical case totalled about $190, including all necessary electrical equipment. Drive-All prices begin well below this, depending on application.

CHECK THESE DRIVE-ALL APPLICATIONS

- ☐ LATHES AND TURRET LATHES
- ☐ MILLING MACHINES
- ☐ GEAR CUTTERS
- ☐ DRILL PRESSES AND RADIALS
- ☐ AUTOMATICS
- ☐ SHAPERS AND PLANERS
- ☐ TAPPERS
- ☐ BORING MILLS
- ☐ SPECIAL APPLICATIONS

This may be just the solution to your production problems, too. Write for the new Drive-All Catalog and address of your local representative. We will gladly study your requirements without obligation.

DRIVE-ALL MANUFACTURING COMPANY

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McCASKEY

TOOL CRIB CONTROL assures

*MORE PRODUCTION with **LESS TOOLS

Tool Crib at Philadelphia Gear Works, equipped with McCaskey Control.

*TIME SAVED IN TOOL CRIB SERVICE

Time studies, confirmed over and over again by every day experience, have shown that tool service with McCaskey Control is much faster than with checks and other systems. More production is the direct result of reducing the non-productive time required for drawing and returning tools. There are no delays at the windows of McCaskey equipped cribs.

Production also is increased by having all the tools in the bins in good condition, ready for use—speeding production and reducing spoiled work.

**TOOLS NOT IN USE CONSTANTLY AVAILABLE

McCaskey provides a simple means for enforcing the return of tools when a job is completed. Tools are kept in constant circulation. They are immediately available instead of accumulating in operators' tool boxes. No time is wasted locating tools that are out, whether loaned to employees or out for reconditioning. You may check, in a moment, where they are and when they were taken out.

McCaskey aids tool conservation by reducing loss, theft and breakage and keeping your entire inventory on the job all the time.

TRANSACTIONS SPEEDED UP

The tool supervisor of a large brass manufacturer says: "The use of McCaskey Tool Control saves hundreds of hours a week for our set-up men, machine operators and crib attendants and has enabled us to materially reduce our crib inventory."

SMALLER CRIB INVENTORY

From the Comptroller of a large electrical manufacturing company: "We also have a *better balanced* tool inventory with smaller crib stocks of numerous items (thru McCaskey). Our tool investment has been reduced and time is no longer wasted searching for tools on the production floor."

Investigate the possibilities of McCaskey for speeding up *your* production and conserving *your* tools. Qualified industrial representatives are available to demonstrate how easily and inexpensively you can have *"more production* with *less tools* thru McCaskey". Write us for facts today.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems, Ltd., Galt, Ontario, Canada. The McCaskey Register Co., Watford, England

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

REEVES *Motodrive*

is Motor + Variable Speed + Gear Reducer

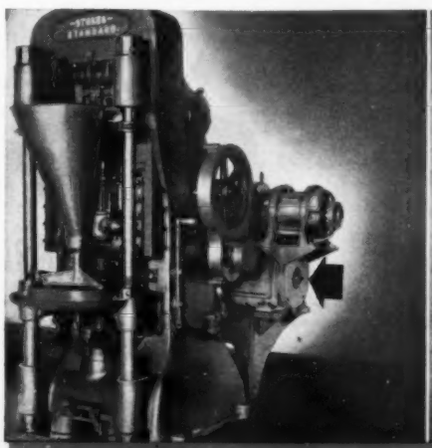
—*All in* 1 *Compact Unit!*

Install This Space-Saving Drive on Your Production Machines and Give Them "Fighting Speeds" for Faster Output

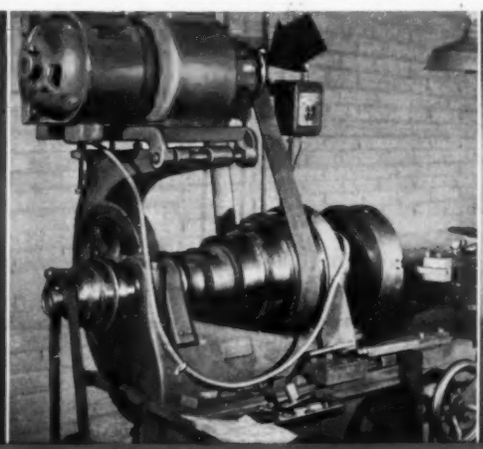
● On production machines where space is limited, or where direct connection to machine is necessary or desirable, the REEVES Motodrive solves the problem of providing infinitely variable and accurate speed regulation. This compact assembly of constant speed motor, variable speed mechanism and gear reducer (if needed) utilizes proved REEVES principle of a V-belt driving between two pairs of cone-faced discs adjustable to form an infinite number of driving and driven diameters. Any desired speed between predetermined limits is available at turn of REEVES Speed Control handwheel—*without stopping* driven machine.

The Motodrive is not restricted to any one make of motor. The unit is available, with or without speed reducer, in two designs, vertical and horizontal. Sizes from 1/4 to 10 h.p. and speed ratios from 2:1 through 6:1. Many different assemblies as to motor, output shaft, handwheel and speed reducer make the Motodrive adaptable for application to any driven machine. Gives any machine "fighting speeds" for more output. For further information on the Motodrive and two other basic REEVES units—Transmission and Vari-Speed Motor Pulley—send for 124-page Catalog Manual AG-419.

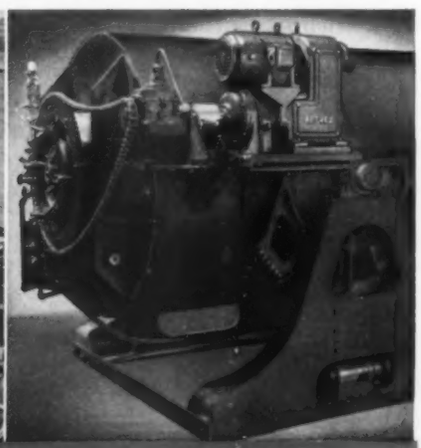
REEVES PULLEY COMPANY • COLUMBUS, INDIANA



REEVES Motodrive provides full-range stepless speed variation on this Stokes Standard Press. This press capable of applying 100 tons pressure in forming plastic or powdered metal parts.



Lathe equipped with the new REEVES Machine Tool Drive. Note curve in sturdy bracket for proper clearance in mounting variable speed unit, in this case the REEVES Motodrive, horizontal design.



REEVES-driven Rotary Carburizer, manufactured by American Gas Furnace Co. Motodrive insures wide range of retort speeds and regulates retort speed for any desired heating period.

Fluorescent Users!

WHEN IT'S TIME TO REPLACE STARTERS OR BALLASTS...

Be sure they're

E·T·L* CERTIFIED

and you'll get the most from your lighting

CERTIFIED E·T·L SPEC NO.6 CERTIFIED E T L SPEC. No.6

Ballasts and Starters—the "control units" that regulate lamp operation—have more to do with the satisfactory performance of your fluorescent lamps than any other part of your fixture. That's why it's important to take these two simple precautions when you need to replace Ballasts and Starters:

1. **Specify Ballasts *Certified* by *Electrical Testing Laboratories.**
2. **Specify Starters *Certified* by *Electrical Testing Laboratories.**

YOU GET THESE ADVANTAGES

Longer lamp life. Greater lighting efficiency. Full use of your wiring system through high power factor ballast. Long life and dependable service from the units themselves. They're built to definite specifications which are an integral part of those set up for Certified FLEUR-O-LIER fixtures by MAZDA lamp manufacturers. They meet these specifications—for they're tested and Certified by *Electrical Testing Laboratories. That means double assurance of dependable, trouble-free operation.

Whether your present fixtures are Certified FLEUR-O-LIERS, Certified RLM, or any other type, insist on Certified Ballasts and Starters for top-notch lighting performance when you make replacements.

If increased war production *necessitates the improvement or expansion of your present lighting facilities, write us for information about Certified FLEUR-O-LIERS, the fixtures that are built to definite specifications to give you Fluorescent Lighting at its Best.*

FLEUR-O-LIER MANUFACTURERS • 2116 B. F. KEITH BUILDING, CLEVELAND, OHIO

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

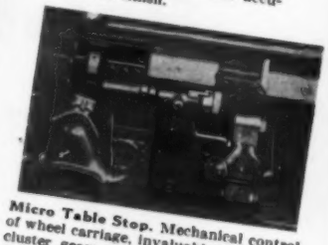
Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

GEARGRIND...

FOUR STAR FEATURES-

TYPE SG-11 GEARGRIND Spline Grinding Machine

Hydraulic Trimmer. Eliminates the human element in trimming. Saves diamond costs. Insures constant accuracy. Gives better finish.



Micro Table Stop. Mechanical control of wheel carriage, invaluable in grinding cluster gears, gears of cramped design and the hob runout of splines.

Cycle Stop and Index Safety. Eliminates wasted grinding time and automatically stops table in case of misindex. Prevents damage to work.

Automatic Forced Feed Lubrication for Work Table Ways. Assures constant lubrication of ways at all times.

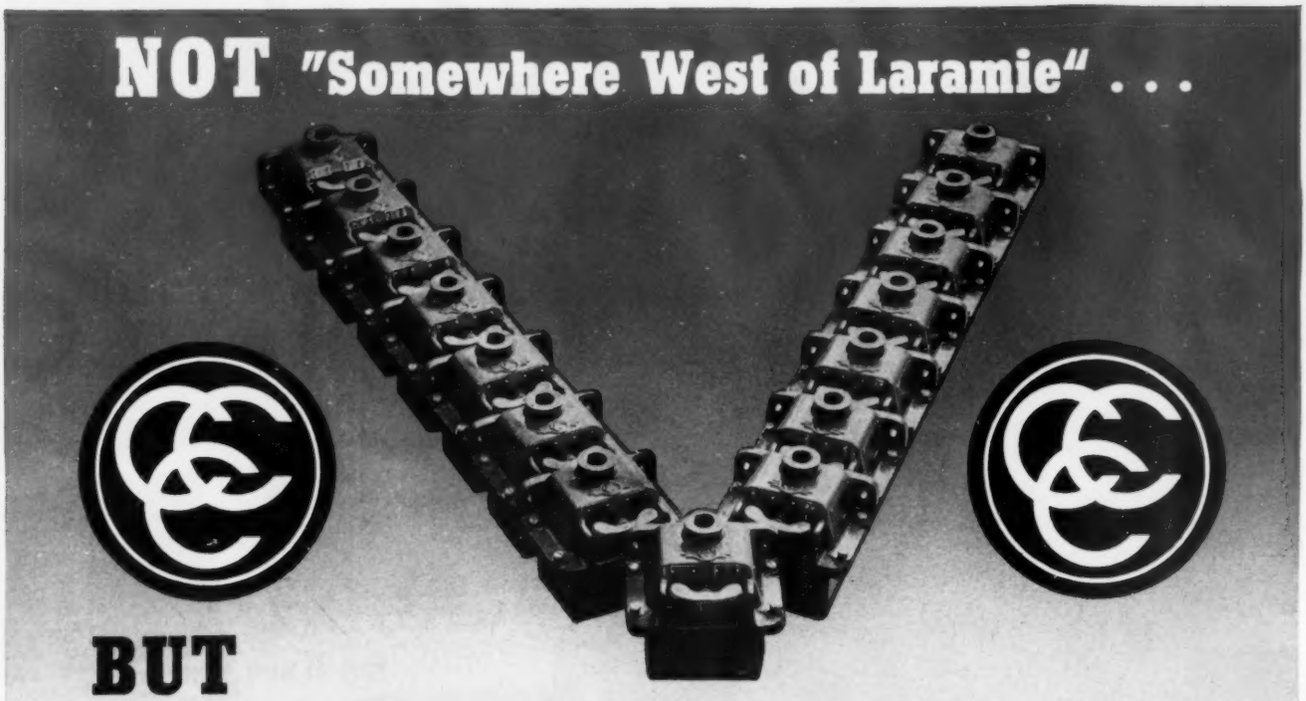
GEARGRIND IMPROVEMENTS
Better Production With
FORMED WHEEL GRINDING

● By reason of improvements made in recent months, GEARGRIND Machines are now delivering greater and better production than heretofore. Their output is consistently good. Inherent advantages of the Formed Wheel method of grinding plus accurate hardened and ground index plates enable GEARGRIND Machines to meet the exacting requirements of war production.

Use GEARGRIND Machines for the production of internal and external gears, external and internal straight or involute splines, serrations and racks.

The GEAR GRINDING MACHINE COMPANY
DETROIT, MICH. U.S.A.

NOT "Somewhere West of Laramie" . . .



BUT

Somewhere Deep in the Heart of Industrial America

Maybe in an explosives plant—maybe where gas fumes lurk—maybe in dust laden atmospheres—but someplace where an explosion would wreck an industrial plant—these "3C" Bulletin 100, Type D Heavy Duty Push Buttons are "lined up" in a "V for Victory" Production Drive.

They're built to rigid underwriters' specifications for Class 1, Group D, Hazardous Locations, either with or without oil. The addition of oil eliminates the action of corrosive gas, and smothers any arc generated at the contacts.

Conveniently located operating lever can be manipulated with a gloved hand—but ample guards on each side prevent accidental operation—and the Station can be locked in either "OFF" or "STOP" position.

The same sturdy mechanism found in all "3C" Type D Push Buttons is used in these Explosion Proof Buttons—Silver to Silver Button Type Double Break Contacts—Bakelite Insulation Parts—plenty of clearance and wiring space—all parts replaceable with screw-driver—and other features.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

This Simple Idea . . .
is SAVING BELTS
for *Industry*. . . and Rubber for the *Nation*

To see for yourself the belt-saving importance of the CONCAVE SIDE, just pick up *any* V-belt and bend it as it bends when it goes around a pulley.

As the belt bends, grip its sidewalls firmly with your fingers as in the photograph above. You will feel the sides of the belt *change shape*. If the sides were straight before bending, they will *bulge outward* as the belt bends. (See Figure 1 on the right).

Now look at Figure 2. Here you see how bending changes the shape of a belt that is built with the patented Concave Side. The side becomes perfectly *straight*. This belt, when bent, precisely fits its sheave groove. Here are the savings:—(1) There is no side-bulge. This means *uniform* wear—*longer* life—a saving in belts for you, a saving in rubber for the Nation. (2) The full side-width of the belt uniformly *grips* the sheave groove wall—carries heavier loads without slippage—another saving of belts and a saving in power, too!

Only belts built by Gates are built with the Concave Side, a Gates patent.

What Happens When a V-Belt Bends

FIG. 1

FIG. 2

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

Chicago, Ill.
549 West Washington

New York City
215-219 Fourth Avenue

Birmingham, Ala.
405 Liberty National Life Bldg.

Los Angeles, Cal.
2240 East Washington Blvd.

Denver, Colo.
999 South Broadway

Dallas, Tex.
2213 Griffin Street

Portland, Ore.
333 N. W. 5th Avenue

San Francisco, Cal.
2700 16th Street

SOME WAYS TO CONSERVE TOOL STEEL

4 QUENCHING MEDIA

Their pros and cons

Contrary to the old belief that heat from metal is dissipated by convection, the actual cooling during the first stages of the quench is due to rapid formation and movement of vapor in the liquid. Not until the metal reaches 600 to 500 deg. F., does convection cooling begin.

Therefore, to improve the efficiency of a quench, keep the medium in motion. This wipes off the blanket of vapor and brings cool liquid constantly in contact with the metal.

The four most common types of quenching media are: water, oil, sodium chloride and sodium hydroxide solutions. Their main characteristics are as follows:

WATER—The most convenient of all quenching media. However, the quenching rate of water drops with a rise in temperature. Near the boiling point it has less than 10 per cent of the quenching rate at 68 deg. F. This is due to the vapor blanket, which prevents effective heat dissipation.

OILS—Produce less distortion and less residual stress in steel, and therefore are well adapted to complicated shapes and steels difficult to harden without cracking. Vegetable and animal oils are rendered gummy by the heat from hot metal and produce offensive odors. Mineral oils are generally used for quenching because of their lower cost and more stable nature. In selecting an oil, several factors should be considered:

1. The oil must have the proper cooling rate to produce the desired properties in the steel.
2. It must be reasonably stable.
3. It should be chemically inactive with hot metal.
4. It should have a high flash point.
5. It should not change cooling rate appreciably with increased temperature.

Some of the mineral oils in general use are: Transformer oil, machine oil, paraffin oil, fuel oil.

SODIUM CHLORIDE—A solution of sodium chloride and water reduces the effect of the vapor blanket, and is therefore more efficient than water. A 10 per cent brine solution is often recommended but higher concentrations are to be avoided. Always rinse the metal thoroughly after a brine quench to avoid corrosion.

SODIUM HYDROXIDE—Solutions of sodium hydroxide give a bright finish to steel after quenching and do not corrode the steel. Only solutions of low concentration are recommended. It should be noted that sodium hydroxide solutions will irritate human skin unless precautions are taken.

After quenching, regardless of the medium used, steel should be immediately tempered. There is great danger of cracking as long as the part contains unrelieved quenching strains. It is recommended that the part be put in the tempering furnace before it has cooled to room temperature, to prevent possible damage from quenching strains.

This material is available in card form, suitable for hanging in shop or office. Write to Bethlehem Steel Company, Bethlehem, Pa., for your free supply.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

American Production is Speeding the Day of Victory—
and Century Electric Motors Aid Production

Photo by
U. S. Army
Signal Corps.

CENTURY MOTORS ARE AS TOUGH AS THE LAND BATTLESHIPS THEY HELP TO PRODUCE

They Withstand the Terrific Shock Loads and Power Demands of the Heaviest Machine Tools

★ The rugged construction of Century Motors, including ribbed frame and braced end brackets, provides the rigidity with which to withstand the heavy shock loads of forming, forging, shaping, and shearing heavy plates and other heavy parts used in armament production.

Century Motors can take the heaviest shocks; working on three-shift production day after day — they're as tough as the land battleships they help produce.

A wide variety of sizes and types of Century Motors — those with standard general purpose characteristics and also those with special speed torque characteristics — are found on machine tools ranging from those heavy brutes forming the heaviest armor to those delicate machines producing the finest precision instruments.

The Century Sales Engineer near you will gladly help you select the right motor for your production machine or for application to any product you sell. His experience will save time and money — call him today.

Century MOTORS

CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Missouri
Offices and Stock Points in Principal Cities

260

One of the Largest Exclusive Motor and Generator Manufacturers in the World

Tripled Capacity

Assures FASTER DELIVERY OF YOUR BROACHES

SINCE the first of the year, the production capacity of Detroit Broach Company has been tripled. An addition to the plant has been completed . . . new machines are already installed and are running twenty-four hours daily, seven days a week.

Detroit Broach Company is the largest concern in the country specializing entirely in the design and manufacture of broaches and broaching fixtures. With our present facilities, it is now possible to promise unusually fast deliveries.

We're equipped and ready to handle *more* of your work . . . NOW!

DETROIT BROACH COMPANY

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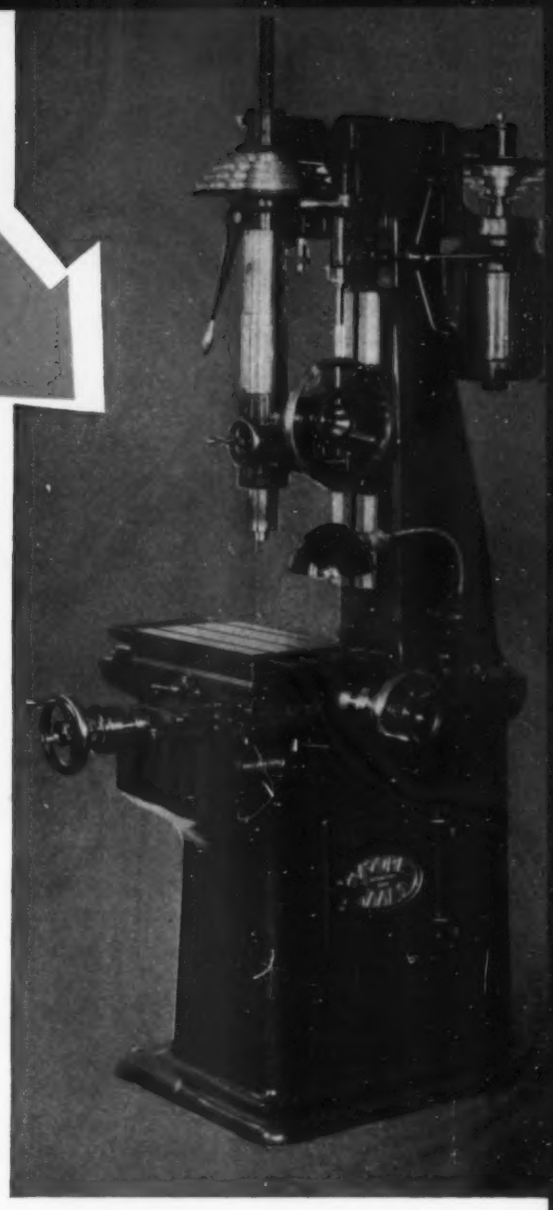
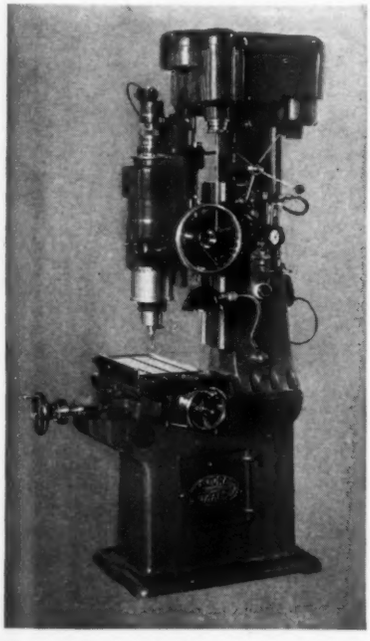
MOORE JIG BORER and MOORE JIG GRINDER



COMPANION MACHINES

that go hand in hand in speeding precision tool and die work . . .



INFINITE SPINDLE SPEEDS from 50 to 150 R.P.M. PROVIDED by the MOORE JIG GRINDER

This companion machine to the Moore Jig Borer will grind straight or tapered holes to size as well as correct location of holes in hardened steel parts. It has a grinding capacity from .030" to 5". It is indispensable as a means of saving time on die and tool work.

10 SPINDLE SPEEDS AVAILABLE FOR ANY JIG BORING JOB

Fast, accurate spotting, drilling, reaming, boring are handled on the Moore Jig Borer with maximum convenience and minimum effort.

This machine follows advanced and time-tested practice in the use of hardened, ground and lapped parts such as precision lead screws and quill. Spindle is supported on four pre-loaded ball bearings. Utmost accuracy and maintained precision so important to any jig borer are assured in Moore design and construction.

Ten spindle speeds are provided with a range from 100 to 2600 R.P.M. when driven by a two-speed motor. Spindle feed is provided in either direction by power or hand and is engaged with friction clutch.

Condensed Specifications

Table Working Surface—10"x16"

Table travel longitudinal—14¼"

Table travel crosswise—9¼"

Table top to spindle end—Min. 3" Max. 16"

Vertical adjustment of quill housing—9"

Boring capacity — (with 2 speed motor) 3½" tool steel; 4" soft steel (with single speed motor) 2" tool steel 2½" soft steel.

Write for* COMPLETE DETAILS *on These Essential Tool Room Machines

Manufactured by

THE MOORE SPECIAL TOOL CO., Inc.

BRIDGEPORT, CONN.

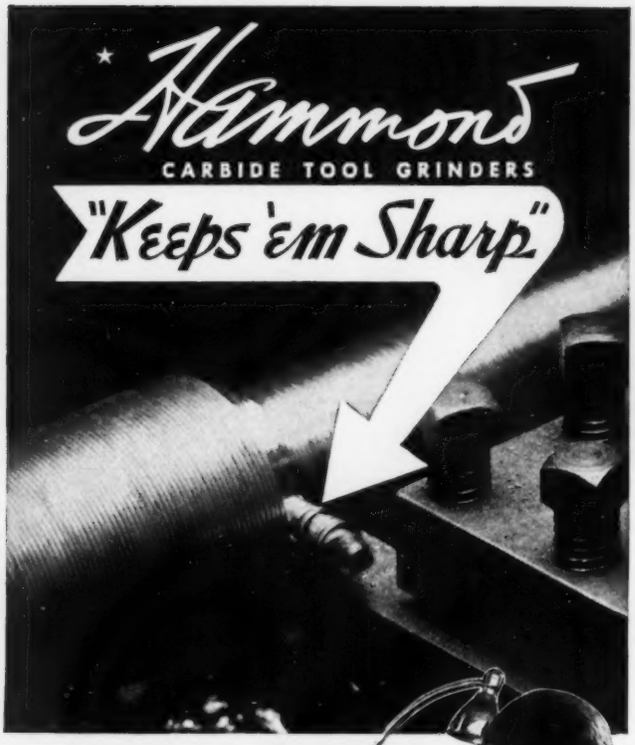
Exclusive Representative

MARBURG BROS., INC., 90 West Street, NEW YORK CITY

Hammond

CARBIDE TOOL GRINDERS

"Keeps 'em Sharp"



*CHIP BREAKER and CARBIDE TOOL GRINDERS

MODEL "4" COMBINATION CHIP BREAKER AND CARBIDE TOOL GRINDER

GRINDERS FOR COMPLETE CARBIDE TOOL SHARPENING MAINTENANCE

Maintaining highest efficiency in YOUR cutting tools to prolong tool-life and insure constant high production rates means one thing: Grind 'em frequently, KEEP 'EM SHARP!

Here is YOUR answer to that problem.

Hammond offers YOU 20 different types in its wide line of Carbide Tool Grinders for rough and finish grinding, and the grinding of chip breaker grooves into Carbide Tools. Each type is modern—with up-to-the-minute features.

Act now—write for complete information. Hammond Grinders will help you maintain that high efficiency so necessary in the speeding-up of YOUR Arms Production. "Beat that Delivery Promise" with Hammond Grinders and sharper tools.

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- ☐ Cleaning Metals Before Processing
- ☐ Cleaning Prior to Plating
- ☐ Cold Immersion Cleaning
- ☐ Cold Spray Cleaning
- ☐ Floor Maintenance
- ☐ Glass Cleaning
- ☐ General Plant Maintenance
- ☐ Hot Immersion Cleaning
- ☐ Magnesium Processing
- ☐ Paint Camouflage Cleaning
- ☐ Paint Department Maintenance
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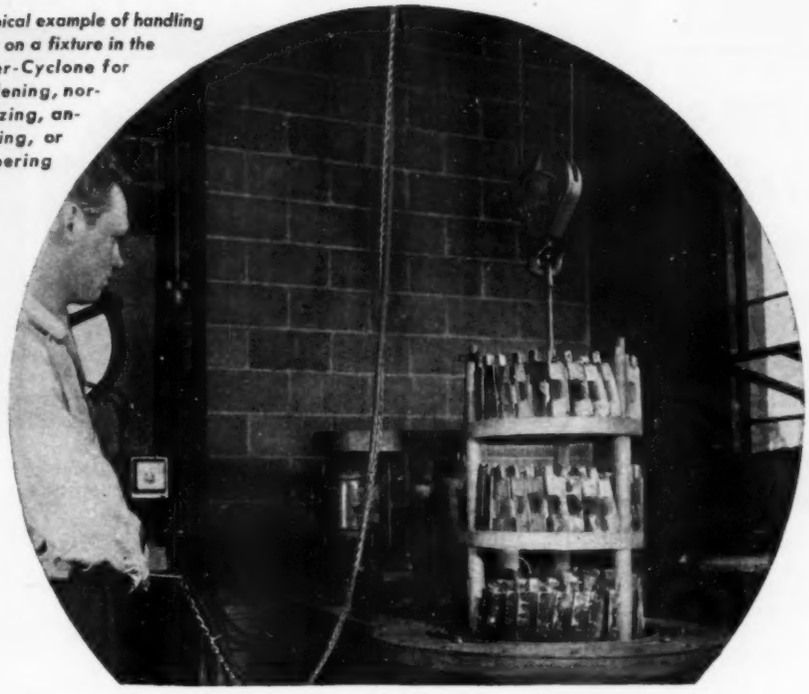


A typical example of handling work on a fixture in the Super-Cyclone for hardening, normalizing, annealing, or tempering

INCREASED PRODUCTION ★ STRAIGHTER WORK

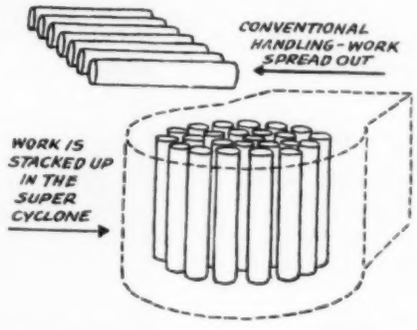
REDUCED HANDLING ★ LESS FLOOR SPACE

Get them all with 100% forced convection heating in the

SUPER-CYCLONE

THE NEW HEATING PRINCIPLE embodied in the Lindberg Super-Cyclone combines a hardening, normalizing, annealing, tempering, and nitriding furnace into one. In addition, the 100% forced convection heating principle increases production, turns out straighter work, reduces handling of material, and generally requires less floor space to give all these advantages. And too, due to the heating and control accuracy within its 250°F. to 1750°F. temperature range, the Super-Cyclone is a highly flexible furnace for the small or medium heat treating shop as well as a heavy production unit for the large shop when put to work on one type of job.

INCREASES PRODUCTION



REDUCES HANDLING

The use of a fixture in the Super-Cyclone eliminates the individual handling of pieces throughout the heat treating process. The parts are loaded onto the fixture and remain there during the heating, quenching, and tempering stages. An added advantage of the fixture is that it can be loaded and unloaded away from the furnace. As a result, the operator is not subjected to high furnace heat as occurs in handling work individually from the box furnace.

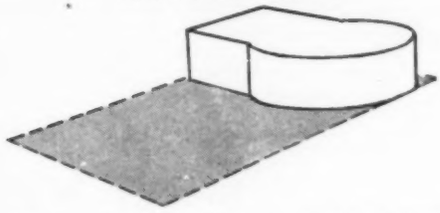
To check the production increases possible in your shop, through the Super-Cyclone, spread an average load of parts on the floor one layer thick, as handled in a radiation type box furnace. Now take another load of those same parts and stack them up in a 36" circle, 4' high, making allowance for spacers and supports. Figure it will take a maximum of 3 hours to heat the stacked up parts and 5 minutes to quench the lot. Ordinarily you will find production increases of from 200% to 1000% possible.

KEEPS WORK STRAIGHTER

The 100% forced convection heating principle of the Super-Cyclone heats the work accurately and uniformly by driving heated air, at high velocity, through the charge. The heat source is confined to a separate chamber, away from the work, thereby preventing heat of a source hotter than the desired work temperature from striking the charge and causing distortion.

Thus, straightening time is eliminated or reduced to a fraction of what is required from conventional equipment. Man hours previously required for straightening are now available for other work.

LESS FLOOR SPACE



As a conservative rule, you can figure that the Super-Cyclone will occupy not more than ⅓ the floor area demanded by any other equipment to handle the same or greatly increased production. This rule is based on averages of what the Super-Cyclone has done in plants all over the country and consequently may not fit all cases.

If you are concerned today with a heavy production schedule, flexibility in your heat treating department, or if your post war plans include economy of operation and maintenance, investigate the Super-Cyclone and all the advantages of its 100% forced convection heating principle. Write for Bulletin 130.

HEAT TREATING HINTS FREE!

Whether the war has brought you into contact with heat treating for the first time or whether you have devoted a lifetime to it, Heat Treating Hints published without charge for heat treaters, offers you valuable "how-to-do-it" information on heating, quenching, straightening, etc.

In the third year of its publication, Heat Treating Hints is read and used by over 8000 heat treaters and metallurgists from coast to coast. Your written request will bring you the latest copy and will place your name on the mailing list for future issues. Write today.

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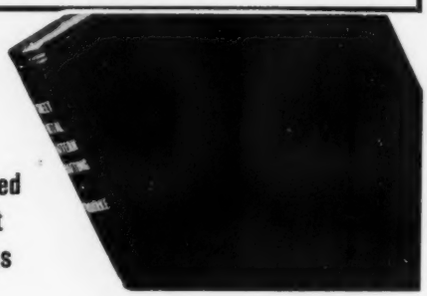
HYDRYZING FOR SCALE-FREE AND DECARB-FREE HARDENING

CYCLONE FOR LOW COST ACCURATE TEMPERING

HOW TO *lay out patterns on sheet metal*

- **An entire chapter on airplane sheet-metal drafting**
- **A chapter devoted to the development of skylight patterns**



HERE is a practical, clear-cut book that will give you a working knowledge of sheet-metal pattern drafting by showing you how to lay out typical, everyday sheet-metal patterns such as are required in industry today. You will gain practical experience—and at the same time develop skill—in pattern drafting by working out the specific problems in pattern layout that make up this book.

Just Published

SHEET METAL PATTERN DRAFTING

By FRANK J. O'ROURKE

Instructor in State University Extension Division, Mass., State Teachers College, Mass., and Sheet Metal Dept., Vocational School, Quincy, Mass.

189 pages, 6 x 9, 192 illustrations, $2.00

THIS sound book is entirely a practical manual of instruction in sheet-metal pattern drafting, presenting typical problems in pattern drafting and demonstrating methods in pattern layout used in practice today. Explicit, simplified directions accompany each problem. These indicate clearly the successive steps to be followed in laying out the pattern accurately from start to finish. Valuable help is added in the Reference Sheets which explain any possible difficulties that may arise in following the steps for the type of work that is being explained.

The three commonly used methods of obtaining accurate development of surfaces are covered: (1) Parallel-line method: applied to prisms and cylinders; (2) Radial-line method: used for all forms which are conical in shape; (3) Triangulation method: applied to all kinds of irregular forms. Throughout, the book stresses the basic fundamentals of sheet-metal pattern drafting that must be applied to laying out patterns of all kinds on sheet-metal.

Shows how to layout such pieces as:

- elbows
- T-pipe joints
- cornices
- round roof flanges
- square roof flanges
- conical chimney cap
- pitched rectangular cover
- twisted square pipe
- gasoline tank
- flat skylight
- pitched skylight
- pilot's seat

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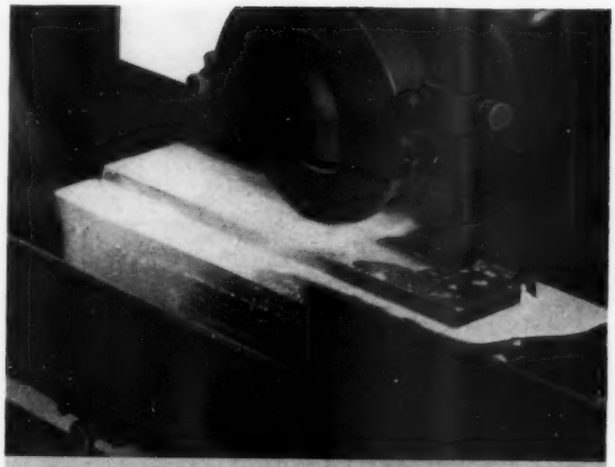

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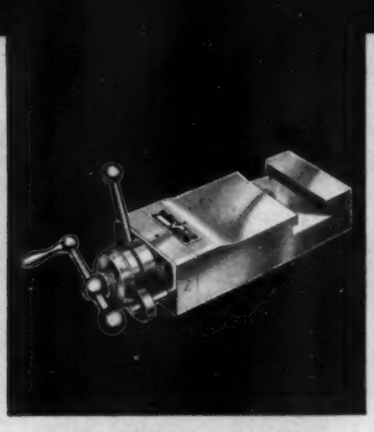
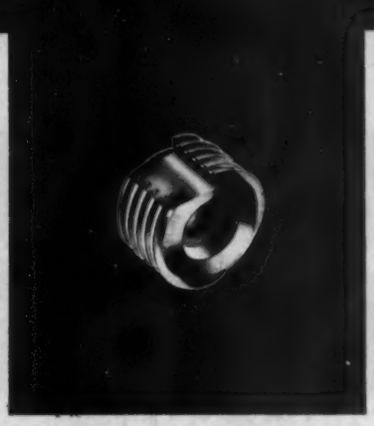
BROWN & SHARPE

CIRCULAR DIVIDING ENGINE—Accurately divides circular discs into predetermined divisions.

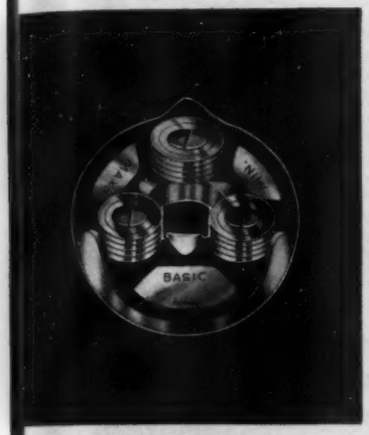


LATHE COMPOUND—For 10-inch South Bend. Quick drawout. Increases thread chasing output 40%.



CIRCULAR THREAD CHASER—Chases threads on lathe work more rapidly and accurately than single point tools.

EXTERNAL COMPARATOR STAND—Rapidly checks outside diameters to close tolerances. Rugged.

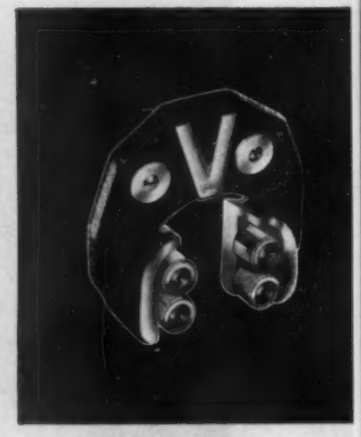


TRI-ROLL GAGE—Efficiently measures male pipe threads. Longer lived than ring gages.

PRECISION PRODUCTION *Requires* PRECISION PRODUCTS

Pictured here are some of VARD'S precision-made inspection equipment and production tools which are helping this country's war-industry plants meet delivery dates and performance requirements. All VARD products conform to prevailing technical standards and represent the best in design, materials, and workmanship.

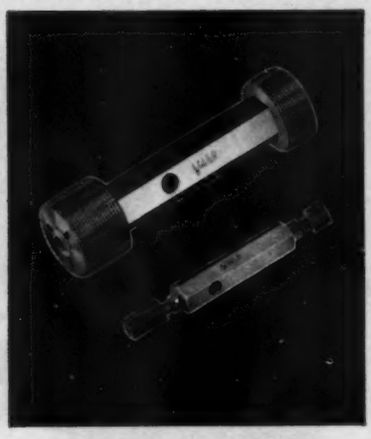
VARD INC. PASADENA, CALIFORNIA



SNAP GAGE—Rapidly checks the pitch diameter, thread form angle, and lead of work under inspection.

LOOK FOR THIS MARK VARD PASADENA, CALIF. *ON ALL VARD PRODUCTS !*

PIPE GAGES; PLUG AND PLAIN RING—Check pitch diameter, taper, and truncation of pipe threads.

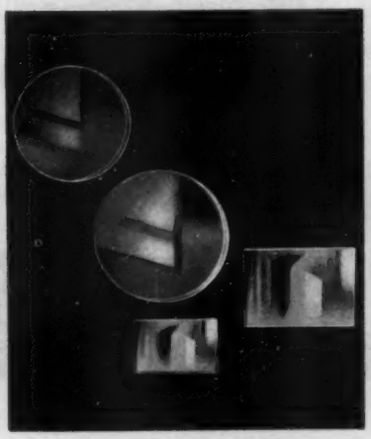


PLUG THREAD GAGES—Check pitch diameter and major diameter of internal threads. Made in all sizes from No. 4 to 6-in.

TWO-PIECE TAPS—Made in larger than usual sizes to conserve high speed steel. Mild steel shank.

SPECIAL TAPS—Precision ground to narrow limits. Available also in special and left-hand threads.

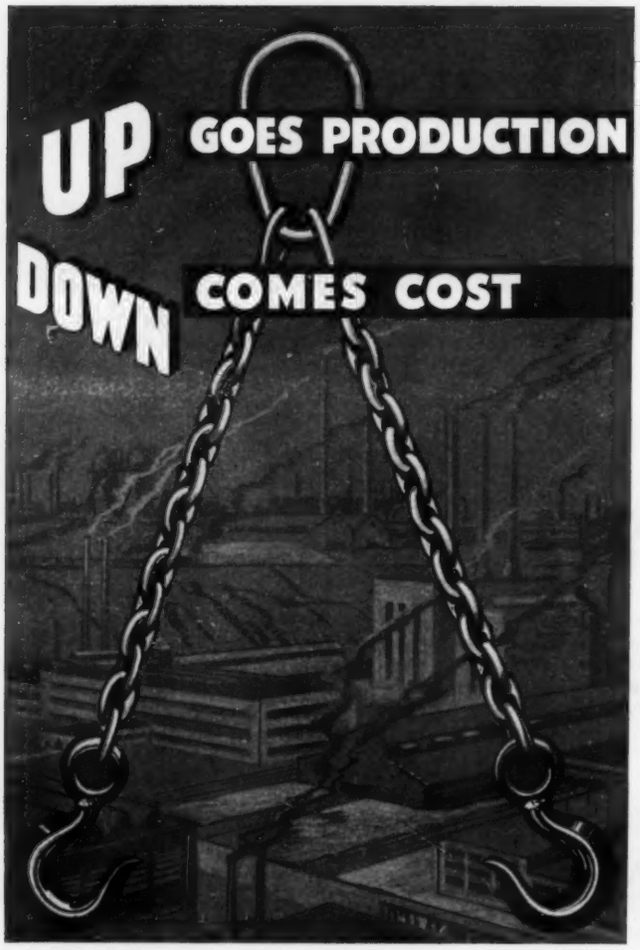
OPTICAL FLATS—Precision made for testing flat surfaces and anvils on testing instruments.



FILTERS AND MIRRORS—Color filters for visual and photographic uses. High reflectivity mirrors.

LENSES AND PRISMS—Precision lenses and prisms for fire control, navigation, and other instruments.

OPTICOTE—Durable films applied to glass to reduce reflection and increase light transmission.



HERC-ALLOY SLING CHAINS

double STRENGTH SERVICE SAFETY

Smooth movement of materials through manufacturing departments means more profits. Herc-Alloy Sling Chains, America's FIRST alloy sling chains, are facilitating speedy production, safeguarding men and materials, and reducing costs in every type of industry.

Fabricated from a high-grade alloy steel of nickel and molybdenum, Herc-Alloy Sling Chains have the endurance and stamina to withstand the toughest industrial assignments. Heat treating under rigid pyrometer control insures uniformity and ductility. Herc-Alloy Sling Chains never crystallize or develop grain growth . . . therefore, they NEVER require annealing. Links are electric welded by the patented "Inswell" process providing 25% more metal at the critical point in the link . . . at the weld. For double strength, service and safety, plus cost-cutting performance, specify Herc-Alloy Sling Chains.

CM manufactures a complete line of chain for every application. Trained engineers are available for consultation on your chain problems. Write for Herc-Alloy catalog today.

COLUMBUS-McKINNON *Chain* CORPORATION

(Affiliated with Chisholm-Moore Hoist Corporation)

124 FREMONT AVE. TONAWANDA, N. Y.

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SURE CURE FOR HEADACHES

Forget your pump worries. You can always count on Tuthill's positive displacement internal gear rotary pumps to meet your small pump requirements. Tuthill pumps are known for their dependability, economy and long life as proved by hundreds of thousands in the field. Make Tuthill your source of supply for these outstanding pumps.

Check your pump needs and write for details today

COOLANT PUMPS—for handling cooling oils on machinery. Complete assemblies and special models designed to be incorporated directly into the machinery. Automatic reversing and pressure releasing types. Capacities up to 50 gpm.

LUBRICATING PUMPS—including complete assemblies and special models for incorporating directly into the design of the machine. Automatic reversing types. Capacities up to 50 gpm.

HYDRAULIC PUMPS—for hydraulic operation on machine tools, engines, and other mechanisms.

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TUTHILL PUMP COMPANY

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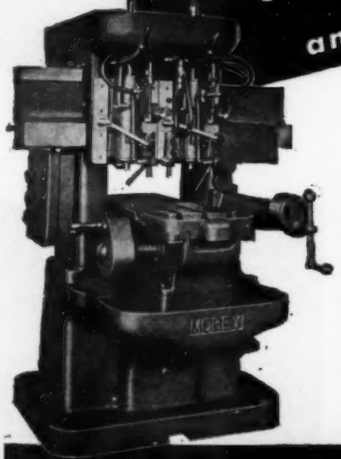
Preloaded Precision Bearings for Spindles

MOREY 12M HIGH-SPEED VERTICAL PROFILER and MILLER



Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

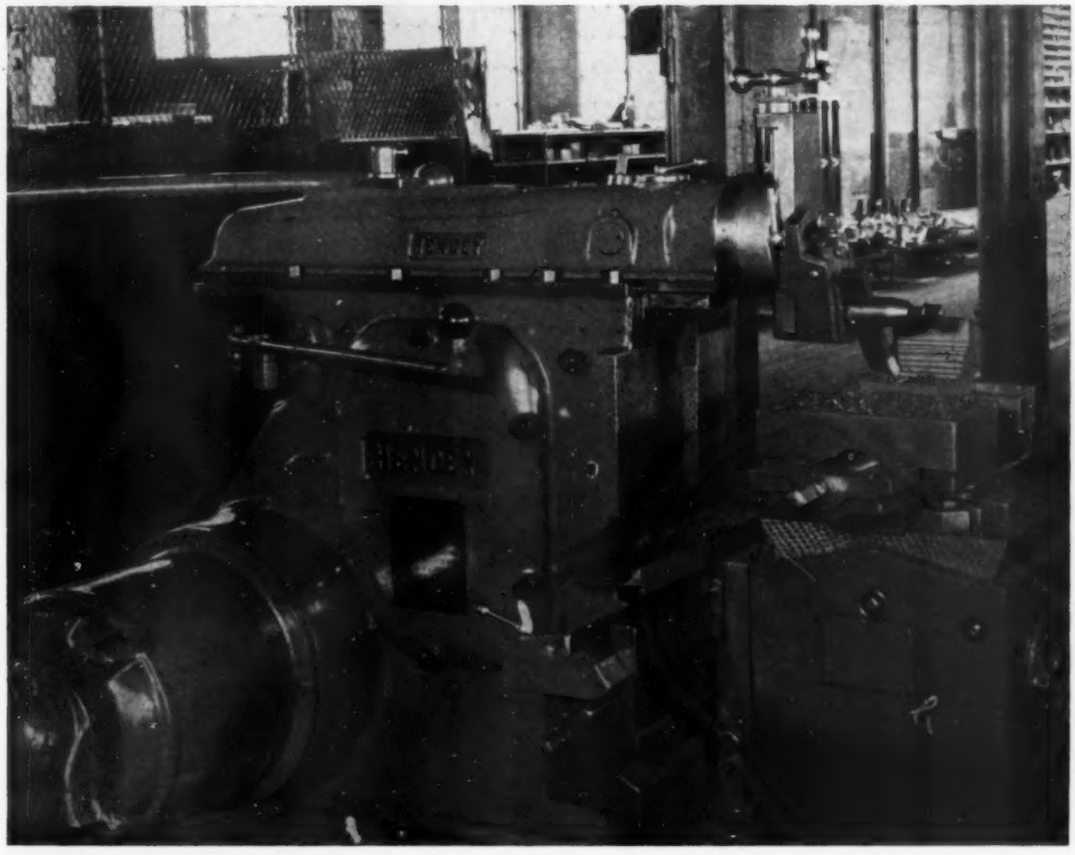
MOREY MACHINERY CO., INC.

410 Broome Street New York, N. Y.

There's Need for a Good Shaper Today—

and HENDEY

BUILDS IT!



THERE are thousands of jobs too small for a planer, and for these the shaper provides an economical and accurate way to perform them.

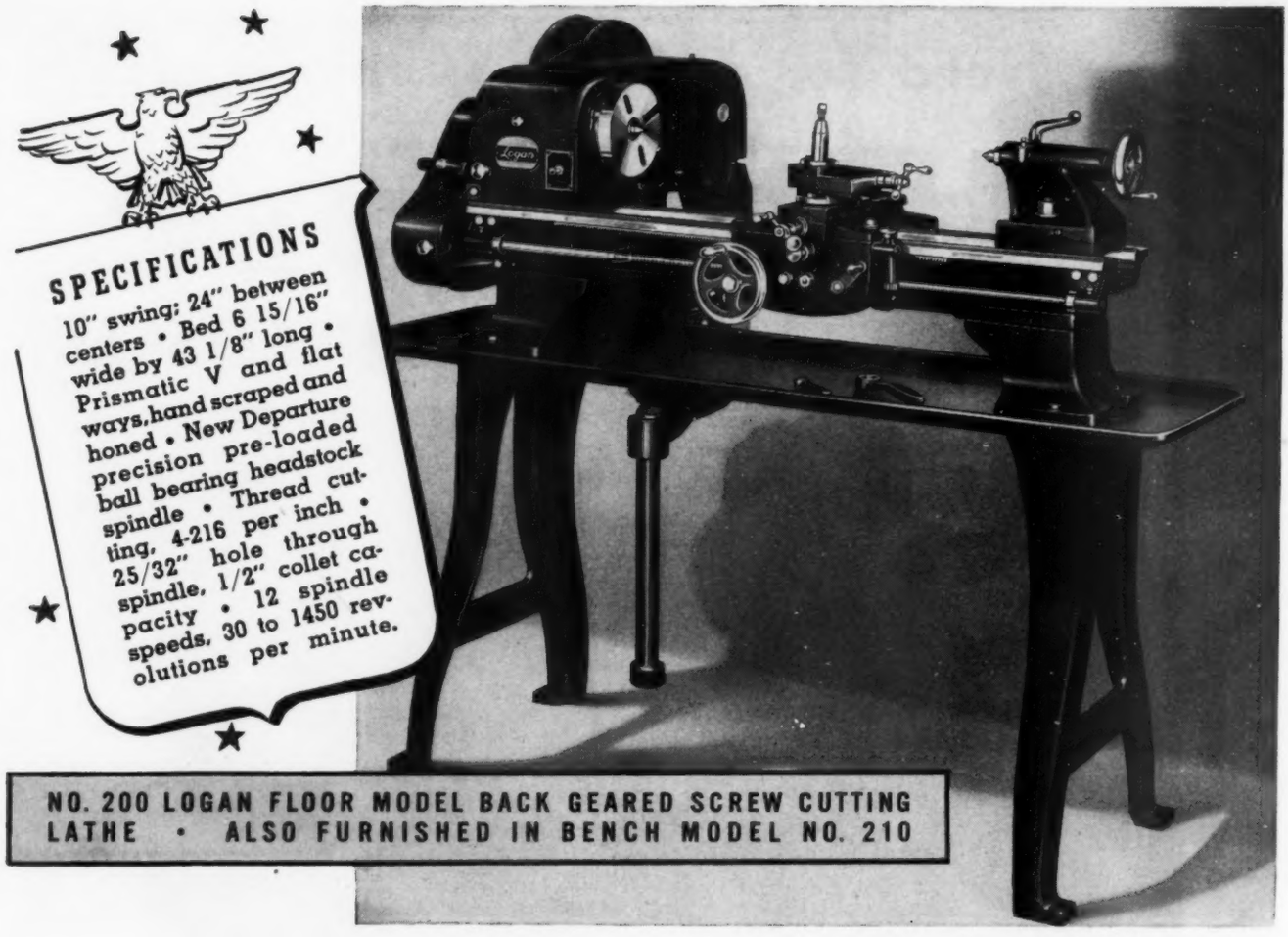
Not only in die and tool-making departments where they are indispensable, but also out in the main machine shops and in that maintenance shop tucked away in the corner.

The Hendey 12" Crank Shaper with its tilting top universal table, power down feed and convenient controls is a precicision machine which commends itself to executives seeking the best in this type of machine tool. You need Hendey Shapers to help you NOW!

THE HENDEY MACHINE COMPANY

TORRINGTON, CONN., U. S. A.

BOSTON • NEW YORK • ROCHESTER • DETROIT • CHICAGO


SPECIFICATIONS
10" swing; 24" between centers • Bed 6 15/16" wide by 43 1/8" long • Prismatic V and flat ways, hand scraped and honed • New Departure precision pre-loaded ball bearing headstock spindle • Thread cutting, 4-216 per inch • 25/32" hole through spindle, 1/2" collet capacity • 12 spindle speeds, 30 to 1450 revolutions per minute.
NO. 200 LOGAN FLOOR MODEL BACK GEARED SCREW CUTTING LATHE • ALSO FURNISHED IN BENCH MODEL NO. 210

A Logan Lathe is a "PLUS" Investment

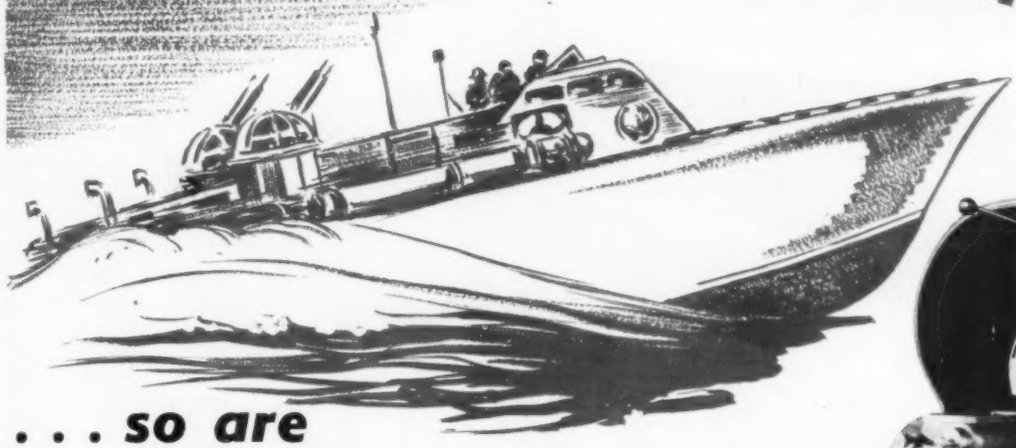
Advanced streamline design and sturdy construction is your first impression of the No. 200 Logan Lathe. Further study presents convincing evidence of higher engineering standards, better workmanship and a wealth of added features — all of which will pay you extra dividends in continuous precision performance and better shop satisfaction.

LOGAN ENGINEERING COMPANY • Chicago, Illinois

Logan A NAME TO REMEMBER WHEN YOU THINK OF LATHES

SMALL IN SIZE—

BIG IN PERFORMANCE!



. . . so are

DALZEN

• VERTICAL •

THREAD GRINDERS

43" WIDE
39" DEEP
72" HIGH

48" WIDE
38" DEEP
75" HIGH

The "mosquito boat" and modern machine tools are alike in one respect — *they're fighting machines!* Mosquito boats and Dalzens are *both* triumphs of design and construction for the work in hand . . . packing tremendous performance in small space. When it comes to thread grinding Dalzens DO MUCH MORE—TAKE LESS FLOOR.

Do much more • *take less floor*

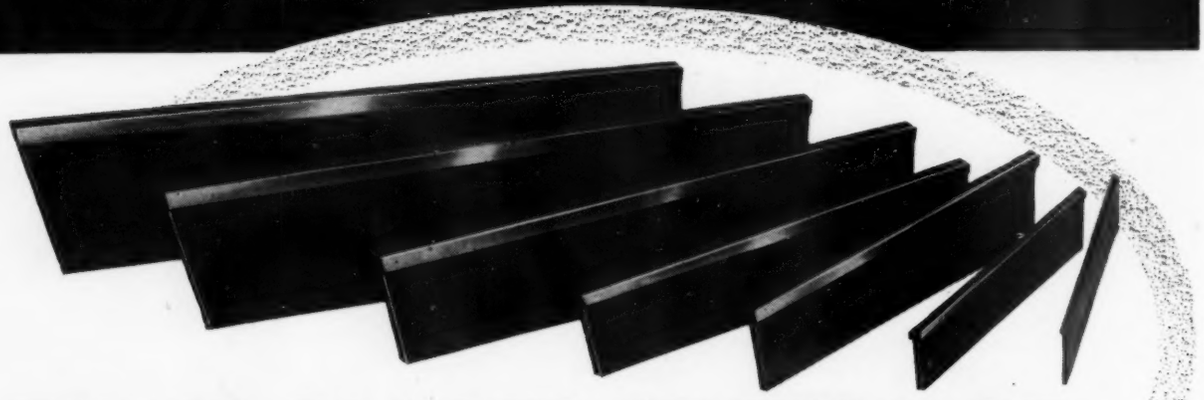
Today two things are of paramount importance in American Industrial Plants: (1) more work, higher speeds and (2) most effective utilization of given floor space. Dalzens meet both requirements and you can use the saved floor space for added equipment or more efficient tool arrangement. Above you see Dalzen No. 2—grinds threads to 4" long anywhere on an 8" shaft, diameters up to 3". At left, Dalzen No. 1—grinds threads to 10" long anywhere on 18" shaft up to 6" diameters. Interested in more output in less space?

• *NOTE—We also manufacture round, flat and form broaches*

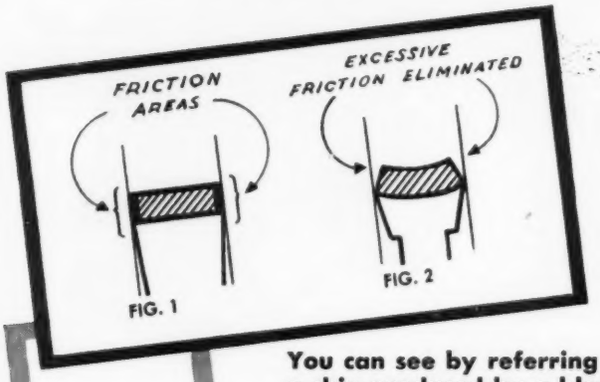
WRITE FOR NEW ILLUSTRATED BULLETINS ON THE DALZEN THREAD GRINDERS

DALZEN TOOL & MFG. CO.
12255 E. 8 Mile Road — Detroit, Mich.

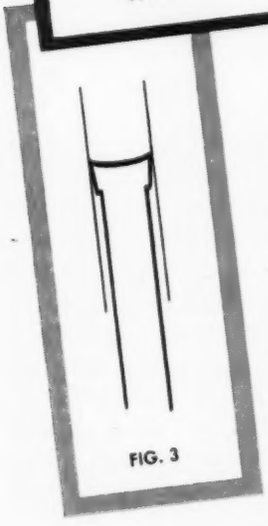
If your production involves CUTTING-OFF OPERATIONS



THESE BLADES SHOULD BE ON *YOUR* MACHINES



If increased production in cutting-off operations means anything to you - if reduction of down-time and fewer breakdowns are factors - if more pieces between grinds interest you - you should use Empire Tool Company's Luers Patented Cutting-Off Blades.



You can see by referring to Fig. 1 that a chip produced by a blade of the conventional type will be flat. The cutting action of the blade causes this flat chip to expand and jam against the walls of the cut, creating excessive chip friction which results in rapid breakdowns of the blade.

A chip issuing from the Luers Blade (Fig. 2) assumes a curved shape conforming with the hollow-ground top of the blade. In this curved form the chip is free to collapse into the concave top of the blade and cause the least amount of contact with the restricting sidewalls. Excessive friction is eliminated.

But this is not the only factor that tends to eliminate excessive friction. The liberal side clearance provided by the distinctive T-shaped design of the blade (Fig. 3), too, serves to reduce friction.

Since this side clearance and the hollow-ground top both extend the full length of the blade, it is apparent that neither of these surfaces require regrinding. They both remain unchanged. That means that the task of sharpening is very simple—so simple, in fact, that even an unskilled operator can do it. Only the front face, or cutting edge, is ever sharpened.

A special gauge permits even an unskilled operator to restore the blade exactly to its former position.

Tell us what equipment you use and we will gladly let you try one of these blades and holders in your own plant under your particular conditions.

Blades, both tapered and parallel on the longitudinal cutting width, carried in stock.

PRODUCED UNDER LICENSE ISSUED BY JOHN MILTON LUERS PATENTS, INC.

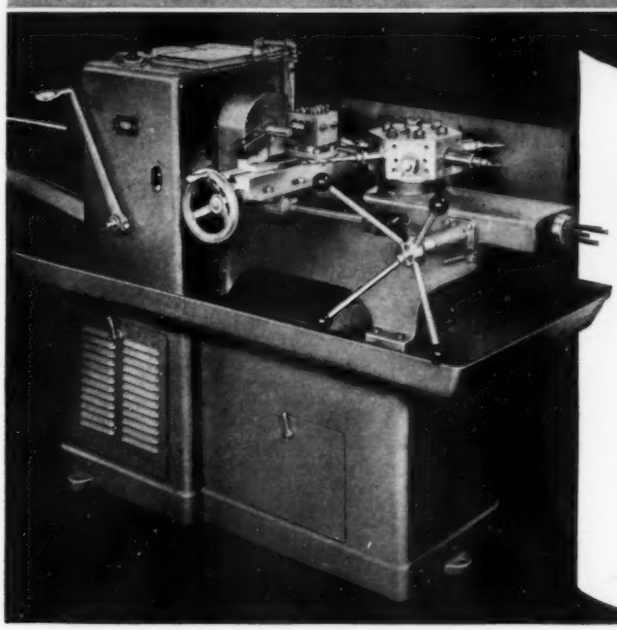
The Blades that reduce friction

EMPIRE Tool Co.

8778 Grinnell Ave.
Detroit, Mich.

BIG ADVANTAGE

OF THE OSTER No. 601 "RAPIDUCTION" LATHE



RELEASES MORE COSTLY MACHINES FOR OTHER WORK

TWO OPTIONAL TYPES OF DRIVE
WORM DRIVE for smooth flow of power required for making heavy forming cuts with absence of chatter and...
DIRECT DRIVE for high speed work on small diameter and non-ferrous metals. Spindle speeds up to 3000 R. P. M. are practical.

On small diameter work not exceeding 1½" (round bar) 1⅛" (square bar) or 1⅝" (hex bar), the Oster No. 601 "RAPIDUCTION" Lathe is used on a wide variety of bar and chucking operations with efficiencies comparable to more complicated, higher priced machines.

In numerous instances, manufacturers have purchased batteries of the Oster No. 601 "RAPIDUCTION" Lathe chiefly to release their automatics for other work demanding that type of equipment.

Furthermore, the manually controlled, six position turret and the SIMPLIFIED construction and use of the No. 601 "RAPIDUCTION" Lathe speeds up training of new operators, thereby releasing more highly skilled operators for other work.

Complete details describing all the advantages of the No. 601 machine are quickly available. The form below offers you a quick, easy way to ask for this information.

OSTER

Let's GO!

THE OSTER MFG. CO. • 2049 East 61st St., Cleveland, Ohio

Rush, by return mail ..... copies of Catalog No. 27-A which contains full description and detailed illustrations of No. 601 Turret Lathe.

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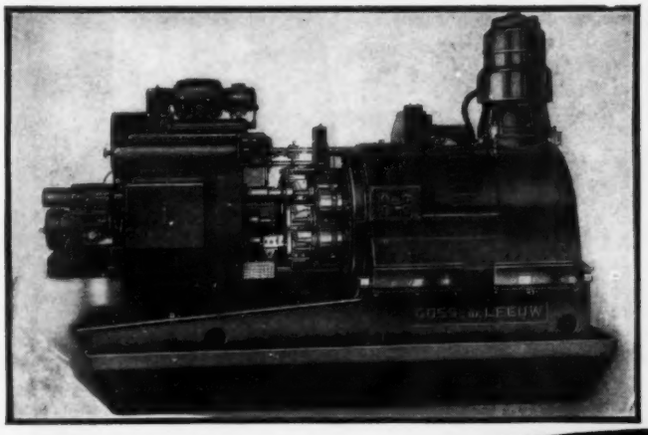
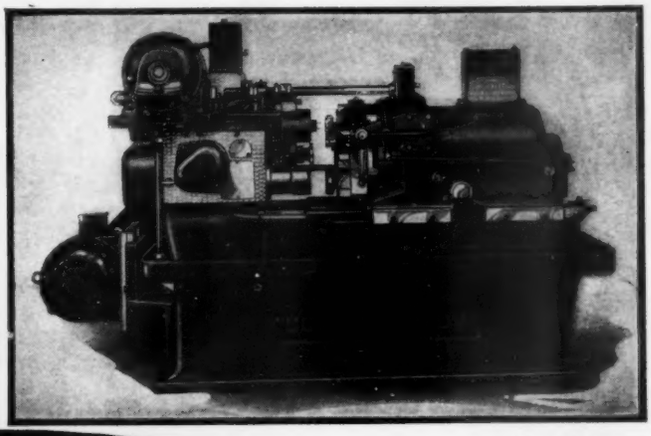
CITY ..... STATE .....





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

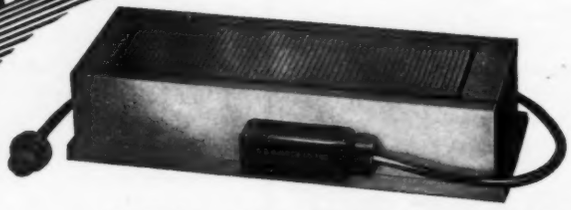
Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

WALKER MAGNETIC CHUCKS

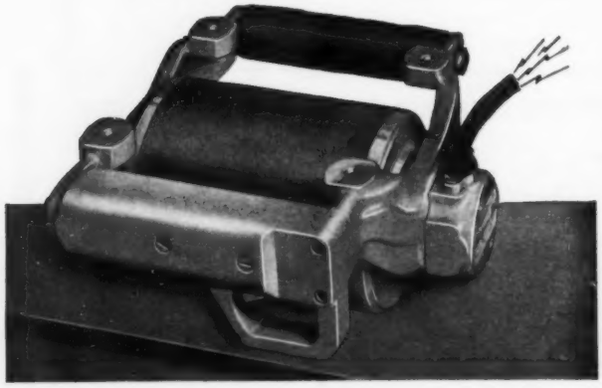
Style B Face Plate—in standard diameters from 10⅜" to 36½" inclusive.



No. 617 Bar Pole Face Rectangular Magnetic Chuck.

DEMAGNETIZERS

Walker DEMAGNETIZERS are available in standard D.C. and A.C. types for either 110 or 220 v. Ask for Bulletin K7 giving detailed specifications.



A FULL LINE OF PROVED STANDARD DESIGNS

Walker offers prompt and complete service on magnetic chucks by carrying in stock a considerable line of Rectangular and Rotary types for use on all surface and internal grinding machines built by American machine tool manufacturers. These units—for grinding, milling, planing and turning operations—are of proved design and are available in such a complete range of sizes as to enable you to select standard units for practically any chucking problem. Write for bulletin W4 giving detailed information.

Also special CHUCKS *for special* NEEDS

The design of Walker Magnetic Chucks is such that "specials" can be developed and furnished at prices only slightly more than standard units. If you require special magnetic chucks for special purposes, consult Walker and be assured of prompt, economical service.

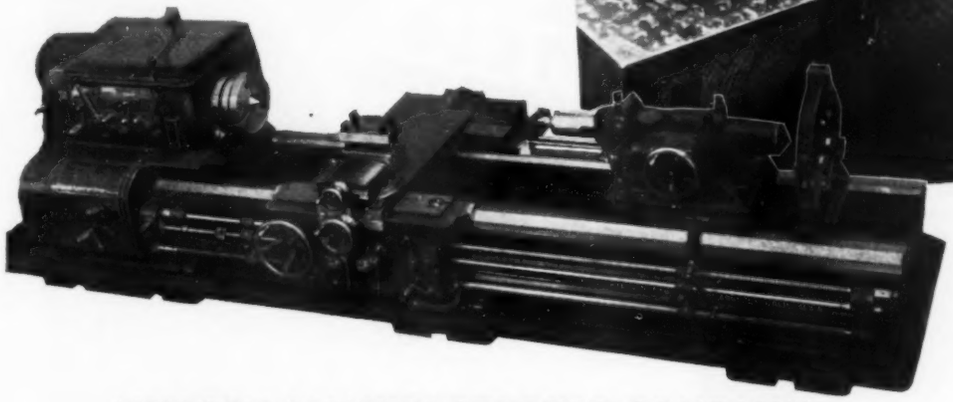
O. S. WALKER CO., INC.

WORCESTER, MASS.

NO RATIONING AXELSON ACCURACY

Although today rationing affects practically every manufacturing step from selection of raw material to delivery of the finished product, there has been no rationing of the engineering skill and craftsmanship that goes into every Axelson lathe. Nor has the individual integrity of any organization come under any priority. "There is no economical substitute for quality." This has been our slogan for fifty years. Translated into practical terms this means that Axelson never has and never will tolerate substitution for first class workmanship and painstaking precision regardless of the measure of business.

Split-thousandth accuracy, specified in every phase of Axelson lathe-building from design to assembly, has given us an enviable loyalty among users—evidence that unexcelled methods and workmanship make Axelson lathes one of the outstanding leaders!



As an example of built-in accuracy, Axelson lead screws are milled in a special room under absolutely controlled atmospheric conditions. Send for complete information on all sizes of Axelson lathes.

AXELSON MANUFACTURING COMPANY

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50 Church Street, New York — **3844 Walsh Street, St. Louis**

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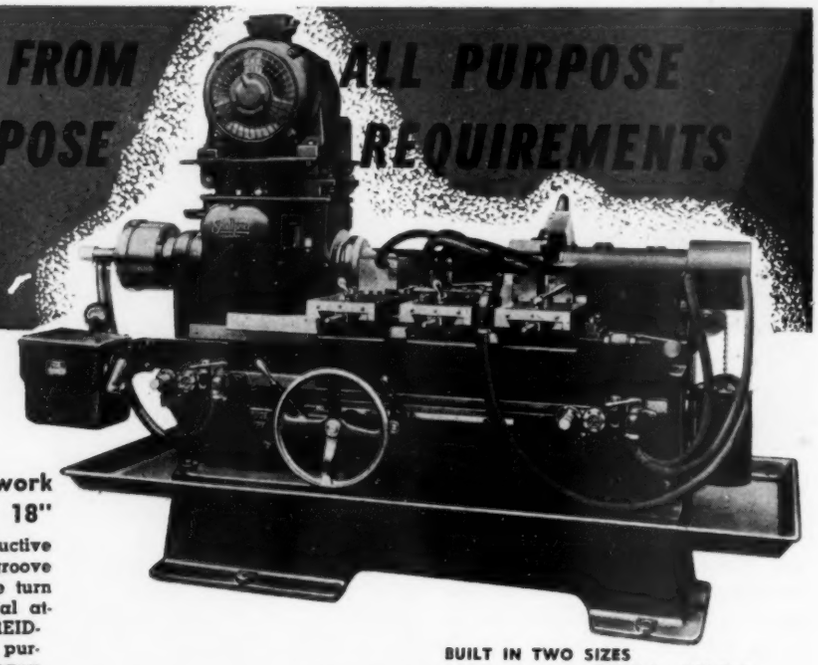
AXELSON 50th 1892 YEAR 1942 THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

BEFORE YOU BUY ANY LATHE INVESTIGATE AXELSON

QUICK CHANGE FROM ALL PURPOSE TO SPECIAL PURPOSE REQUIREMENTS

offered by this



MULTI-TOOL PRODUCTION LATHE

Relieves bottlenecks on armament work up to 58" between centers and 18" swing. This powerful, versatile, highly productive lathe will rough and finish turn, face, bore, groove form, wave, taper turn, vee, skim turn, profile turn and groove. Unit design together with special attachments make it possible to transform the REID-SMALLPEICE LATHE from all purpose to single purpose requirements quickly and easily. It offers many machines in one, thereby providing the means for keeping production moving without delays incident to installing other machines to do the same work.

BUILT IN TWO SIZES

	6 W. S. L.	9 W. S. L.
Swing over bed	12"	18"
Between centers	18"	22"
Admits between centers (long bed)	30"/42"/54"	40"/58"
Spindle Speeds	10	8
No. of feeds	10	15
Floor space	5'1½"x3'0"	7'8"x4'0"

WRITE FOR ILLUSTRATED BULLETIN, GIVING COMPLETE SPECIFICATIONS

SMALLPEICE LTD · 160 ELLIOTT STREET BEVERLY, MASS.

MANUFACTURED IN UNITED STATES BY REID BROS. CO., INC., Beverly, Mass.

TURN HEAVIER LOADS FASTER WITH IDEAL LIVE CENTERS

Get more work, quicker, out of lathes, millers, grinders, etc., with IDEAL Live Centers. They rotate with the work, therefore permit heavier loads—faster speeds—deeper cuts. The radial load is carried by a high precision ball bearing, and thrust load absorbed by a taper roller bearing. All parts are hardened and ground.

TRIPLE DUTY

Three interchangeable Center Pieces (illustrated below) for all kinds of centered and uncentered work. Save set-up time.

OTHER PRODUCTION SPEEDERS

Write for FREE Descriptive Literature

IDEAL COMMUTATOR DRESSER COMPANY

1057 Park Avenue Sycamore, Illinois

SALES OFFICES IN ALL PRINCIPAL CITIES

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IF you can't get all the machine tools you need—try to get more production from those that are now in your shop. Unless you have been using Teco Carbide Tools, it's a safe bet that you are not getting full capacity from your machines.

Teco Carbide Tools are distinctive for their unusual hardness, density and uniformity. They hold their cutting edges longer; cut at higher speeds; produce more pieces between grinds; maintain accurate tolerances for longer runs. Try TECO Carbide Tools and be convinced. Grades and styles for practically every machining need, available for prompt shipment.

TECO CARBIDE TIPS FOR IMMEDIATE SHIPMENT. Standard grades, styles and sizes.

TUNGSTEN ELECTRIC CORPORATION

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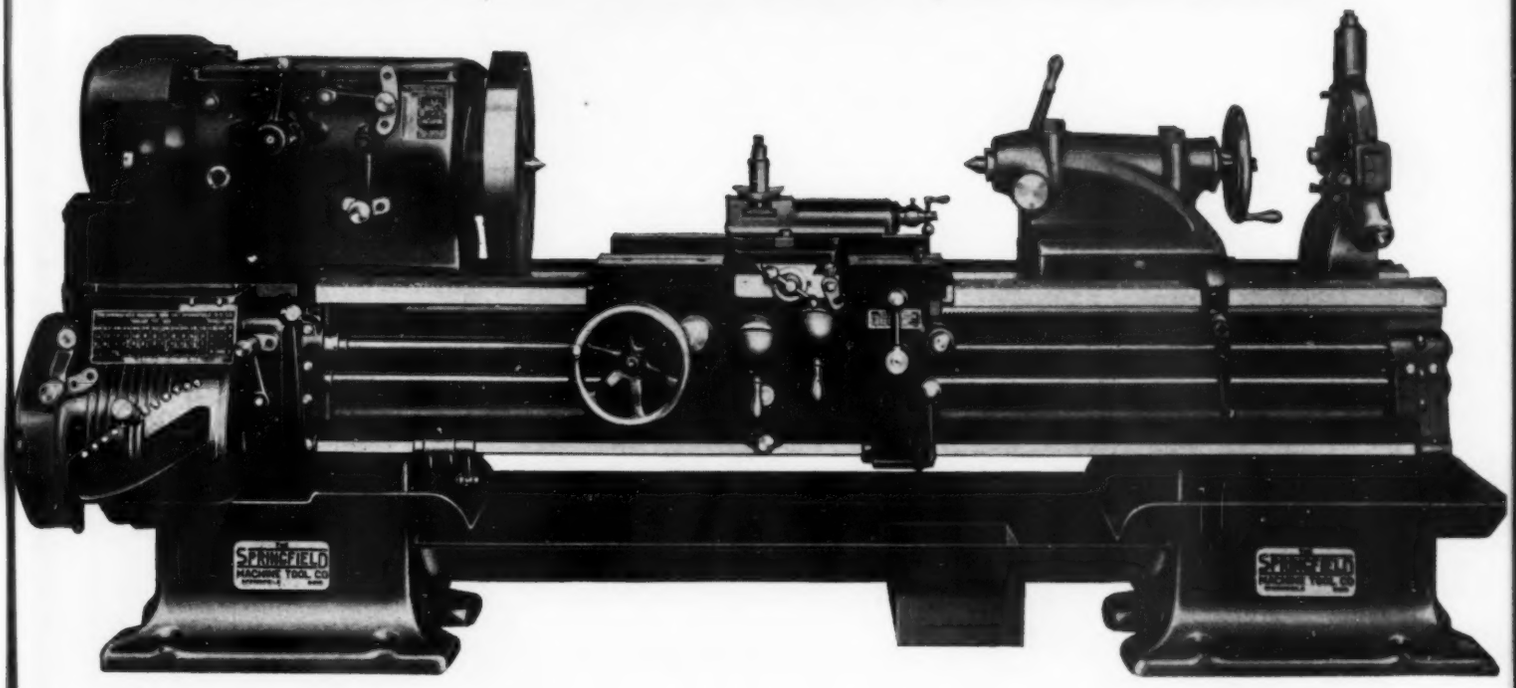
Pioneers in Tungsten Carbides for Over a Quarter Century

TECO

Choose SPRINGFIELD



GEARED HEAD LATHES

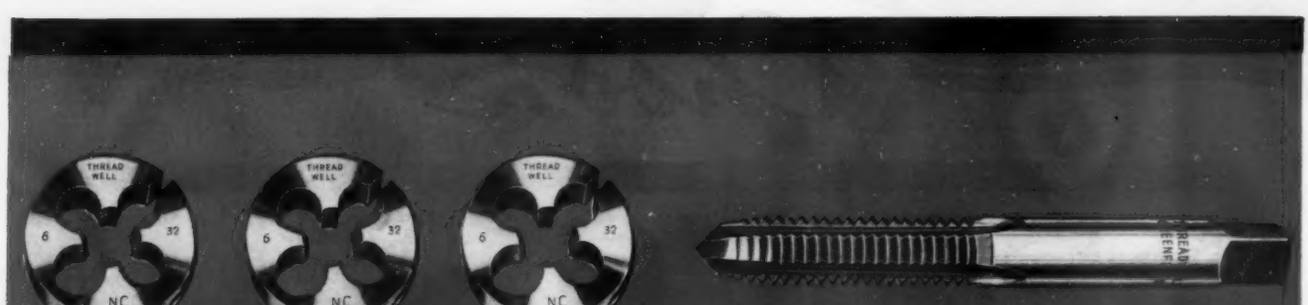
• Many are the problems that face industry today, no small one being that of increasing production for war purposes. In this respect, you'll find it to your advantage to choose SPRINGFIELD Geared Head Lathes.

From the ground up, a SPRINGFIELD Lathe represents superior construction and design. All heavy castings, including the bed, are cast in our own shop . . . gearing is designed for maximum efficiency . . . attachments demonstrate unusual engineering ingenuity . . . lubricating systems and power transmission are built to take it, 24 hours a day. In fact, to fully understand what SPRINGFIELDS can do for you, check their superior metal turning records in other shops . . . and judge for yourself.

Under current emergency conditions, make it SPRINGFIELD Geared Head Lathes . . . *they'll do your job better, now and later, too!* Sizes range from 14" to 30." Write concerning deliveries, prices, etc.

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.



Accuracy

We write our V for Victory on gleaming rods of high speed steel. Each Threadwell Tap is fashioned by men and machines devoted to accuracy of the highest order. These taps . . . these threads . . . are our contribution to speed the final

V

Threadwell

THE NEW NAME FOR SUPERLATIVE THREADING

THREADWELL TAP AND DIE CO. · · · GREENFIELD, MASS.

SALES AGENTS: Canada - BRIDGE MACHINERY COMPANY, Montreal. England - SKYLUX, LTD., London.

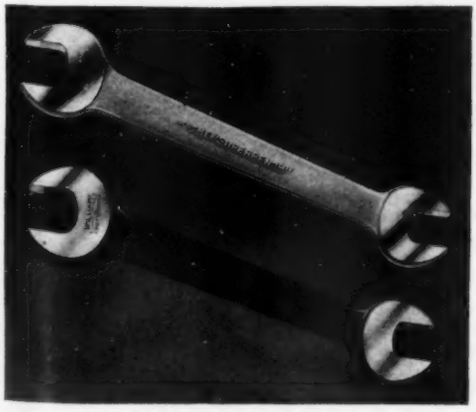
HOW AND WHY
WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools*, BUFFALO, N. Y.

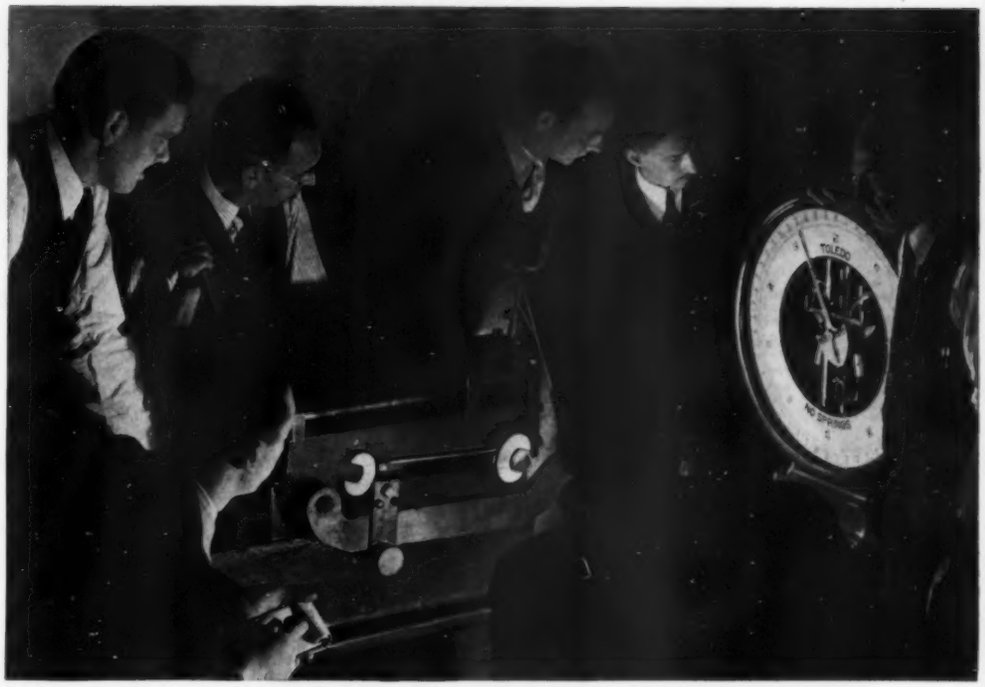
WILLIAMS' "SUPERIOR" (CARBON STEEL) WRENCHES

For some years previous to the war, the popular trend was toward replacement of this type of wrench with alloy steel tools which usually were chrome-plated and more highly finished. Today, however, material shortages and the need for critical economy makes a close examination of the relative merits of carbon and alloy steel wrenches particularly timely. Since we manufacture *both* types, we can present the following facts and figures without bias or prejudice.

Williams' "Superior" Wrenches are forged from carbon steel, specially processed to exacting specifications. These wrenches have been improved to a point where they are substantially twice as strong as the earlier carbon steel wrenches of our own manufacture. Comparative tests demonstrate that they average (throughout all patterns and sizes) 93% as strong as our corresponding alloy steel wrenches. In the popular Double-Head Engineers' pattern,



Comparison of Double-Head Engineers' Pattern of Alloy (top) and Carbon Steel wrenches. Both wrenches have same openings.



Comparative strength tests were made in Williams' Laboratory with every size and type in the carbon and alloy steel wrench lines.

"Superior" (carbon steel) Wrenches are *actually stronger* than the corresponding sizes of alloy wrenches which are of thinner design. Other patterns in the Williams' line are forged from identical dies whether of carbon or alloy steel—thus the *average* shows a slight strength advantage in favor of alloy steel.

Against this slight advantage are the following practical considerations: Alloy steel wrenches cost nearly twice as much as "Superiors"; critical alloys are needed in many items of war production where substitution is highly undesirable; in the Double Head Engineers' pattern, the thicker design of "Superior" Wrenches affords a more comfortable hand grip and a better bearing on the nut; the usual finish supplied on "Superior" Wrenches involves no critical material (such as chrome), since they are finished in baked-on enamel rather than plating.

Economize with Carbon Steel Wrenches

In view of today's conditions, we strongly recommend the use of "Superior" (carbon steel) Wrenches wherever possible. For most industrial applications, any advantage in alloy wrenches is negligible. Some types of close-quarters work require the thinner heads available in the Double-Head Engineers' pattern of alloy wrenches, thus justifying their higher cost.

An informative booklet, providing comprehensive data on standard wrench types is available without charge. Write for "How to Select and Use Wrenches."

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere

"Blount"

"COMBINATION" MODEL J

WET TOOL GRINDER

meets todays need for speed and accuracy

This machine is a valuable contribution to fast production. It is equipped with straight faced wheels for wet grinding, is remarkably convenient in operation and can be depended on for cool, clean grinding.

Modern and improved features include:

. . . heavy column with ample coolant tank and water pan of generous capacity.

. . . guards of heavy cast iron with hinged covers and adjustable spark protectors.

. . . centrifugal motor-driven ball bearing pump with all bearings above water line.

. . . spindle of high carbon steel, machine turned and ground.

. . . deep groove ball bearings protected against grit.

. . . exclusive design Blount grinding rest incorporating coolant ejector which assures cool tools and clean wheels.

. . . totally enclosed motor with manually operated switch having overload protection.

. . . foot treadle switch (available as an extra) keeps machine running only while operators foot depresses treadle.

Write for Bulletin A-8

COMPLETE DETAILS AVAILABLE ON REQUEST

CONDENSED SPECIFICATIONS

Base of Column—22" x 19½"
Height base to spindle—37½"
Spindle Arbor—1¼"
Wheels 12" x 2" x 1¼"
Between wheels—22½"
Spindle speed—1750 R.P.M.
Motor—2 HP.

J. G. BLOUNT COMPANY *Everett, Mass., U.S.A.*

SHELDON Back Geared Screw Cutting PRECISION LATHES

For the Tool Room

The finest 10", 11" and 12" lathes ever built in the moderate price field. Large special analysis steel spindle GROUND ALL OVER, with extra collet capacity. Hand-scraped Bronze, Ultra-Precision Ball or Super-Precision Roller spindle bearings, (the finest bearings obtainable). Heavy braced, semi-steel beds with hand scraped ways (2 V-ways and 2 flat ways) These lathes come with a choice of aprons, gear boxes, and drives including the anti-friction, 4-speed, V-belt Lever-operated pedestal base motor drive illustrated. Telescopic Taper Attachment and other accessories available.

For Production

Sheldon Lathes will stand up to any production work within their capacity—are ideal for second operation work. Production models available with any or all of these features: Ultra-Precision Ball or Super-Precision motor spindle bearings, Lever-operated Collet Attachment, Lever-operated Tail Stock, Lever-operated cross slide with double tool post, Lever-operated turret, etc.

For Machine Shop

Both Bench and floor models with choice of Semi-quick or Full-quick Change Gears, Plain Aprons or Worm Feed Apron with Power Cross Feed. Overhead, Back or Underneath Motor Drives—Telescopic Taper Attachments, Tool Post Grinders, Milling attachments and all standard accessories.

Write for Catalog and name of nearest distributor.

SHELDON MACHINE CO., INC.

4234 N. KNOX AVE. CHICAGO, U.S.A.

If we design the CENTER—you won't be in the MIDDLE

A properly engineered LIVE CENTER is one of the fundamentals of setting up a job and requires a specialist's experience . . Our engineering is based upon forty years of tooling for metal working operations.

Send us your specifications and blueprints . . we will see that your job is set-up with the right Live Center.

STURDIMATIC TOOL COMPANY

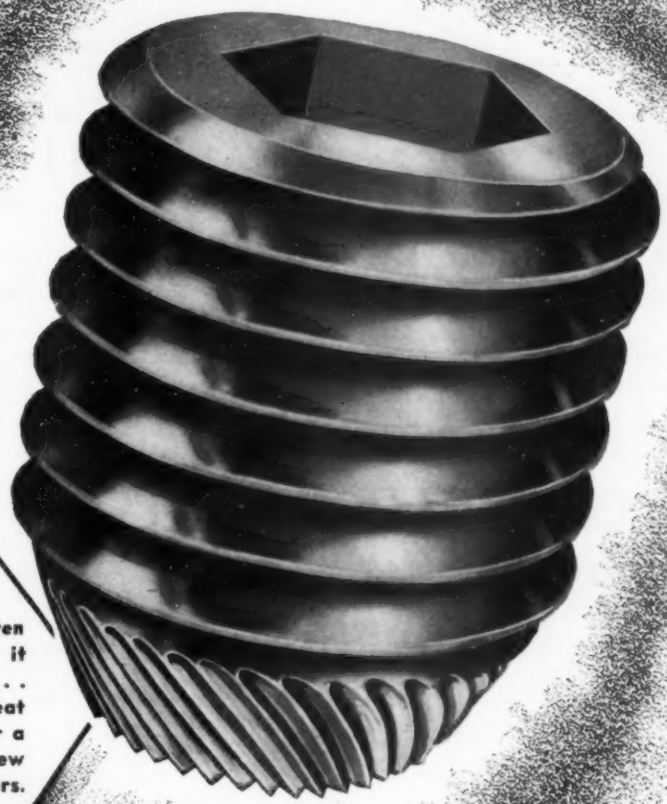
5214 THIRD AVE. DETROIT, MICH.

LOCKS AUTOMATICALLY

WHEN TIGHTENED

UNBRAKO

SELF-LOCKING HOLLOW SET SCREWS
with the Knurled Points



A NORMAL pull will tighten the Knurled "Unbrako" so it automatically locks in place . . . a distinct advantage of great importance as there was never a sure way of locking a set screw before "Unbrako" Self-Lockers.

THE Knurling of the point is so cleverly done as to offer no resistance when "Unbrako" is tightened up. As soon as vibration tries to back it off, the Knurls immediately dig in and prevent loosening. It can't vibrate loose by itself. Further, it can be used again and again, and locks equally well regardless of how often adjusted.

You can eliminate many maintenance costs and breakdowns with "Unbrako" Self-Lockers. Write today for details.

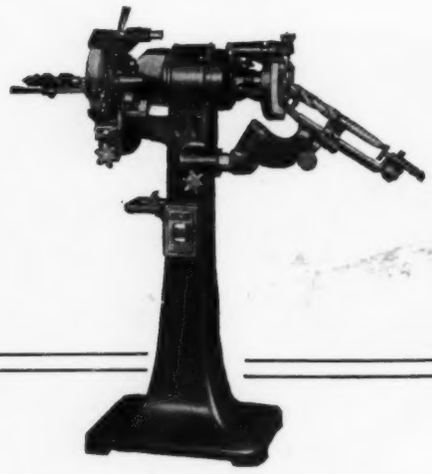
The KNURLING of Socket Screws originated with "UNBRAKO" years ago.

STANDARD-PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 4
— BRANCHES —
BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

Send for the "Unbrako" catalog showing the complete line of "Unbrako" Screws

Reg. U.S. Pat. Office
UNBRAKO *Screw Products*

Grand Rapids



COMBINATION DRILL AND TAP GRINDERS

Model 10-B

Sharpens Taps, 2, 3 and 4 Flute, Right or Left Hand. Sizes #6 to one and one half inches.

Sharpens Drills, 2 and 3 Flute, Straight or Taper Shank. Sizes from one eighth to one and one half inches.

"Sharp Drills and Taps
Cut Holes in Rising
Production Costs."

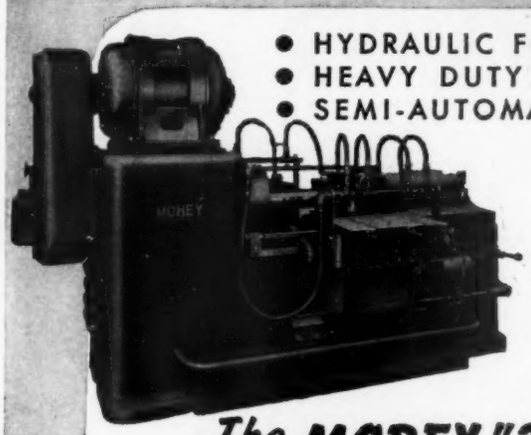
Other Combinations Also Available

•

Write for
complete descriptive literature

GALLMEYER & LIVINGSTON CO.
300 Straight Ave. S.W.
GRAND RAPIDS MICH.

Suitable for 105 M.M. to 155 M.M. Shells



- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

YOU NEED THIS WRENCH

SPEEDS WORK

The only socket wrench that accommodates *two different sizes of* nuts in each head.

Users report that nut-tightening operations are speeded up at least 75% by the *FAVORITE Reversible Ratchet Wrench. No time is lost shifting the wrench off and on the nut at each quarter turn. Full socket grip prevents wrench from slipping; avoids rounding of nuts and saved skinned knuckles. Designed for use in narrow spaces; over long studs; and instantly reversible.

Three sizes of handles; each handle takes five different heads; each fits two different sizes of nuts. Carried by leading mill supply houses.

*Reg. U.S. Pat. Off.

GREENE, TWEED & CO.
Bronx Blvd. at 238 St., New York, N. Y.

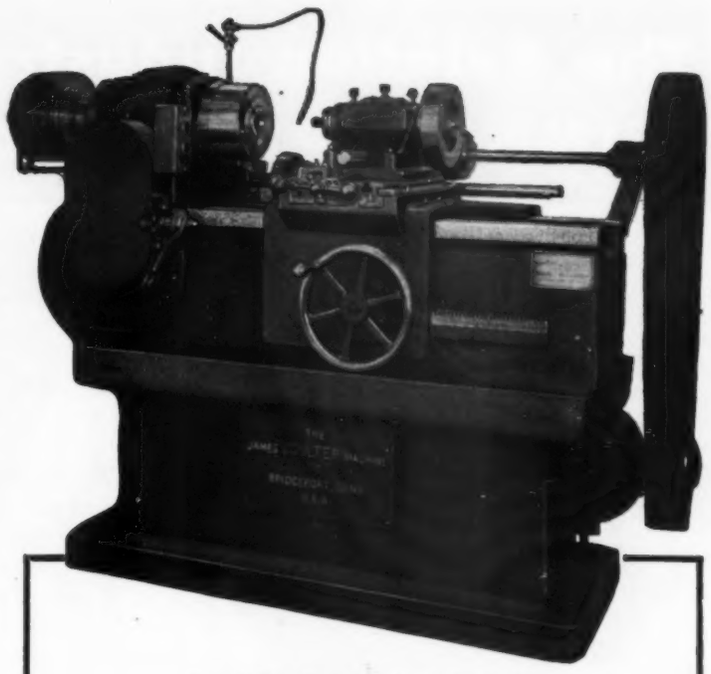
FAVORITE* *Reversible Ratchet Wrench*

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James **COULTER** *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

AMERICAN TOOL HOLDER

Reduces tool bit breakage
Saves trips to the tool crib
No tool waste
No heating up

THE American Tool Holder holds, *with a wide, immovable grip,* all square or round tool bits and boring bars within its capacity—*without the use of spare parts.* This superior holding device will not break high speed steel or cemented carbide bits—short bits are held as solidly as long bits. *Each holder will hold three sizes of bits in four positions.* The tool requires less clearance grinding in an American Holder, because the shank is parallel to the tool.

Mail the coupon for complete details on the four standard sizes.

Please send complete information on the four standard sizes of American Tool Holders

Name ..... Title .....

Company .....

Street .....

City ..... State .....

A.M.

EDWARD BLAKE COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

J-B TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS

The Aviation Industry Has Turned to SUNNEN PRECISION HONING

Write for
FREE BULLETIN
—giving complete information. Or, if you prefer, a Sales Engineer will call and demonstrate this equipment in your plant on your job.

For *Speed—Accuracy—* and *Super-Smooth Finish*

★ Close tolerances — super-smooth finish for perfect functioning of parts, while important to other industries, are *vital* throughout the field of aviation.

That's why practically every leading producer of airplanes, the manufacturers of aviation instruments and controls, has adopted Sunnen Precision Honing for sizing and finishing internal cylindrical surfaces from .185" to 2.400" — quickly, accurately, and at a lower cost.

Does Not Require Skilled Labor

Workers in "teens" can handle jobs in "tenths" after a few hours' instruction and practice!

This practical, inexpensive, economical machine can be set up and work located in one minute. Size adjustment can be made while machine is in motion with work on mandrel. When expensive reamers or broaches get a little undersize, many manufacturers remove the last thousandth or so with the Sunnen Precision Hone. Relieves big internal grinders for other jobs.

Corrects errors of out-of-roundness or taper caused by previous operations. Maintains alignment. Facilitates duplication of sizes.

In plant after plant, the Sunnen Precision Hone is showing production increases of 100% to 500% with corresponding savings in costs. For faster, lower-cost honing of small diameters, put Sunnen equipment to work in your plant.

SUNNEN PRODUCTS COMPANY
7941 Manchester Avenue, St. Louis, Mo. • *Canadian Factory: Chatham, Ont.*

SUNNEN

Typical Examples

As you can readily appreciate, we cannot publish detailed information on Sunnen "success stories." However, here are a few general examples of the type of aviation parts being handled on the Sunnen Precision Hone.

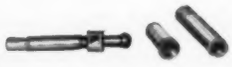
Aluminum Aircraft Link "produces high finish without bell-mouthing."

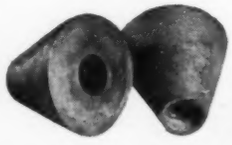
Saved time in producing a smooth, accurate finish on this bronze remote control valve body.

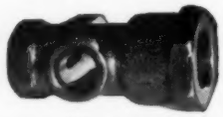
Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.

"Produced an extremely accurate and glass-like finish."


Airplane Engine Parts accurately honed to a super-smooth finish.


Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."


Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Drill Jig Bushing "Increases sales appeal of product."

Hardened Steel Ring Gauge — finished to an accuracy of .000025" for roundness and straightness.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

IN PLANTS LIKE *YOURS* . . . . ON OPERATIONS LIKE *YOURS* . . .

Etnas ON THE JOB

. . . MAY BE DOING THE WORK FASTER, BETTER and CHEAPER!

. . . . HERE, IN POINTING TUBING

prior to drawing, this ETNA No. 412 SWAGING MACHINE demonstrates a "natural" operation for ETNAS . . . it gives a smooth, clean, open point, as well as volume output.

How about your plant? . . . and your operations? Perhaps you don't point tubing, but are you turning out new jobs, such as shells, axle housings, tubular shapes, etc. If the sizing, tapering or reducing of round solids or tubing is one of your operations, consult with ETNA about the application of Swaging as a short cut to increased production. ETNAS are swaging small tubular assemblies, too . . . further proof of their versatility! In capacities from ¾" to 8" and die lengths from 1" to 18", there's an ETNA unit suited for your job!

It's important today, because of the Production for Victory program, to be completely aware of every recognized method of turning out more quality work in less time. In this respect, we urge you to "ask ETNA About Swaging."

IF IT'S A QUESTION OF TAPERING, SIZING OR REDUCING OF ROUND SOLIDS OR TUBING

"Ask ETNA about Swaging"

THE ETNA MACHINE COMPANY

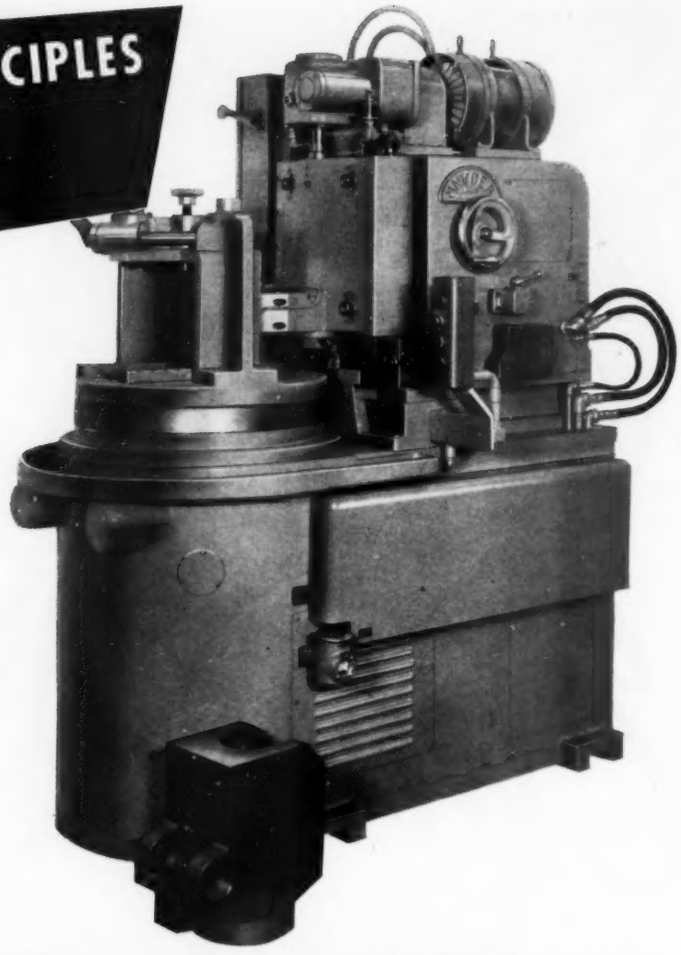
TOLEDO . . . OHIO

AUTO PRODUCTION PRINCIPLES APPLIED TO MAKING GUN PARTS!

★

SNYDER SPECIAL HYDRAULIC MACHINE

for



MILLING EXTRACTOR TRUNNION POCKETS IN BREECH RING

This Snyder special machine demonstrates how the needs of the hour have transformed a highly specialized "tool shop" operation into an automobile production type of operation with corresponding gain in volume.

The operation consists of cutting kidney shaped slots and is done without special attachments such as tracers or duplicators.

The work cycle of the machine is as follows. When the work piece is loaded in the locating fixture and the cycle starting button pressed, the tool spindles start to rotate and the tool spindle slide advances into position while the fixture table starts to oscillate the work through a short arc which controls the shape of the slot.

The depth of the slot is cut in steps which are adjustable from a few thousandths of an inch to 1/32″ deep per oscillation of the table. The oscillation of the table and the tool advance are hydraulically operated and electrically controlled. (The hydraulic step-by-step tool advance can be disconnected and the tool advance accomplished manually, if desired.)

Because of the semi-automatic work cycle, the production of this machine is a great deal higher than ordinarily accomplished by previous methods.

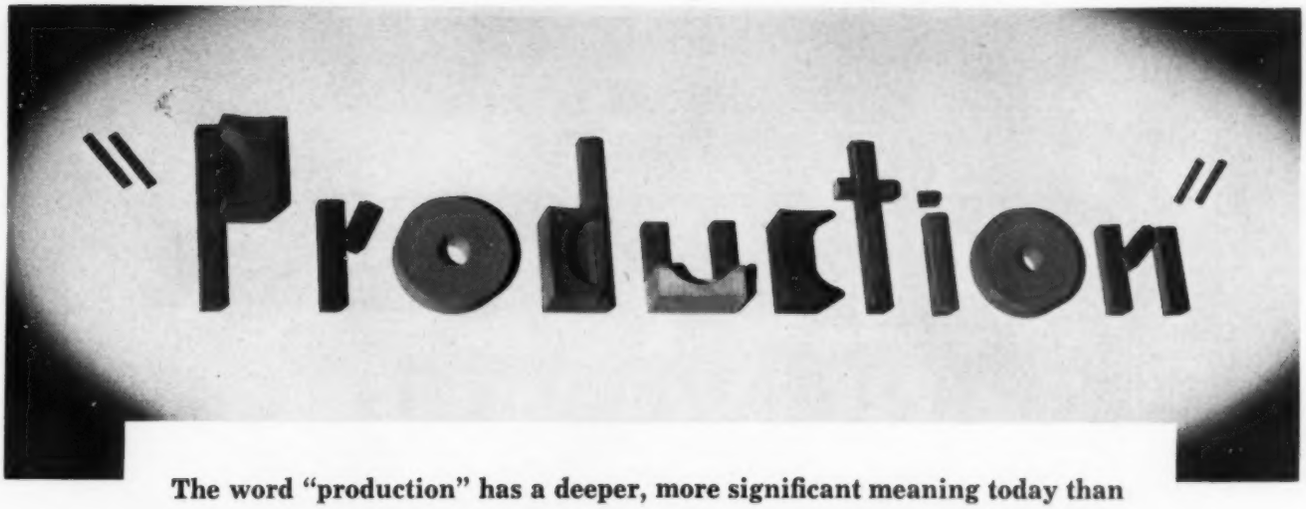
Noteworthy are the stops for the main slide which are bevelled at 45° and located one on either side of the ways. These not only stop the slide but also hold it down on the ways for greater rigidity.

This type machine is also available in larger sizes for larger parts.

If greater production is one of your problems we invite your inquiries.

SNYDER
TOOL & ENGINEERING CO.
2400 E. Lafayette Ave. • Detroit

designers and builders of machinery for **HIGH** *production at* **LOW** *unit cost*



The word "production" has a deeper, more significant meaning today than it ever has had in the history of man. In many respects it is the most important word in our language. The nation or group of nations that can out-produce its enemies will win this war — and win the peace to follow.

As manufacturers of high quality honing and superfinishing stones, grinding wheels and sandpapers, the MID-WEST ABRASIVE COMPANY is playing a part in this great industrial drama and we have ample basis for the statement that MID-WEST products more and more are being depended upon to assist in increasing the production of ships and tanks and planes and guns.

MID-WEST honing stones, for example, are used in the manufacture of virtually 100 per cent of the guns being produced for the United States Navy as well as most of those being built for the United States Army. MID-WEST grinding wheels and MID-WEST coated abrasives also are being employed extensively in the creation of those things needed to preserve democracy. There is a reason for the selection of MID-WEST abrasives by those engaged in that all-important work and that reason, summed up, is: DEPENDABILITY.

MID-WEST abrasives are DEPENDABLE abrasives. Moreover, they are manufactured under a process that guarantees uniformity of hardness, grain structure and cutting capacity. They have a longer effective life than most abrasives and when they wear down they wear down uniformly. Why not let our engineers help YOU increase YOUR production? Samples shipped from stock immediately.

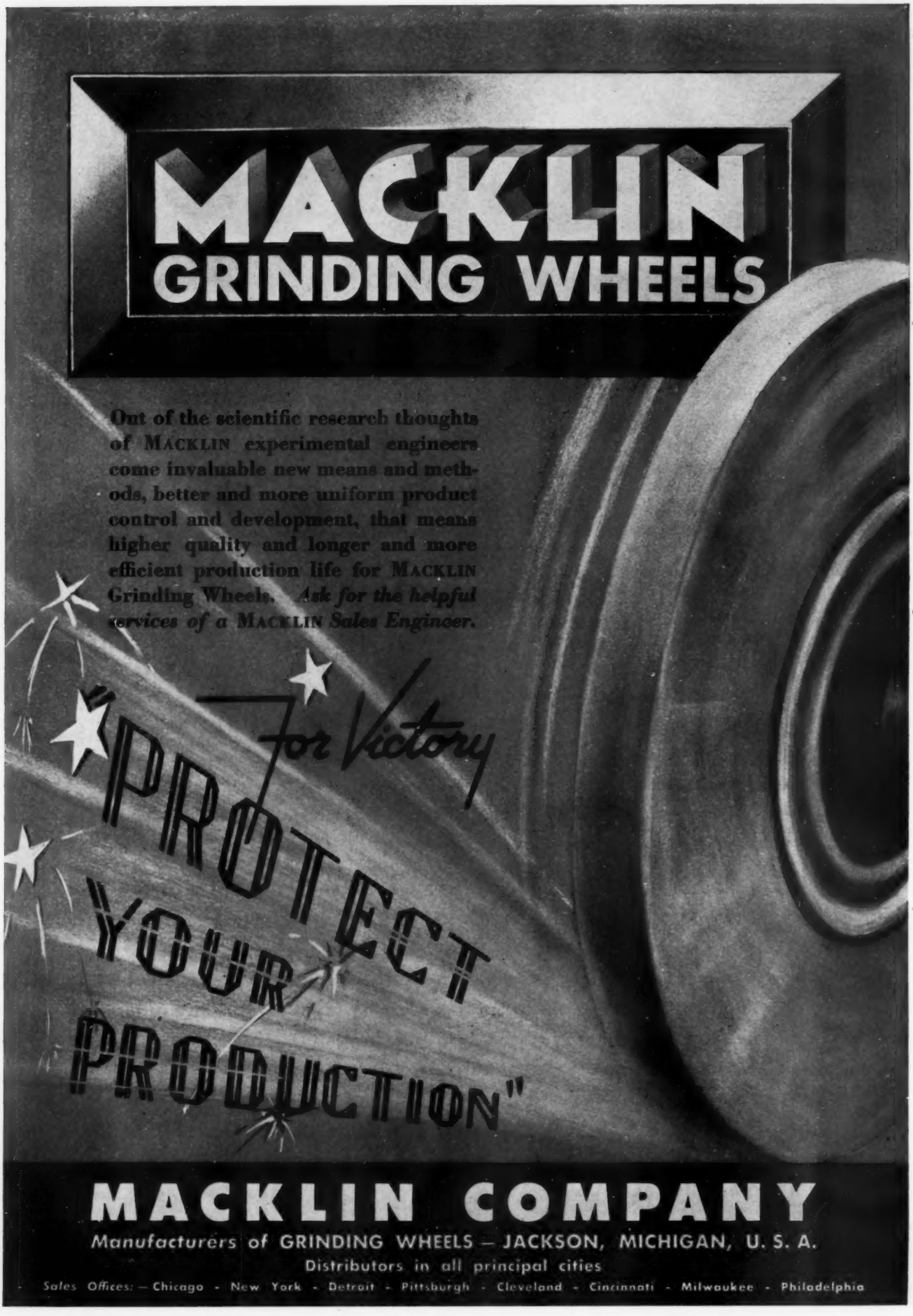
Mid-West

MID-WEST ABRASIVE COMPANY

Manufacturers of dependable abrasives

1960 E. Milwaukee Ave. Detroit, Michigan

MID-WEST ABRASIVES


MACKLIN
GRINDING WHEELS
Out of the scientific research thoughts of MACKLIN experimental engineers come invaluable new means and methods, better and more uniform product control and development, that means higher quality and longer and more efficient production life for MACKLIN Grinding Wheels. Ask for the helpful services of a MACKLIN Sales Engineer.
For Victory
"PROTECT YOUR PRODUCTION"
MACKLIN COMPANY
Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.
Distributors in all principal cities
Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

UNEXCELLED

FOR ACCURACY · SPEED · FINISH

FEATURES THAT MEAN INCREASED PRECISION PRODUCTION

★ Hill Vertical Spindle *"Open Side"* Hydraulic Surface Grinders incorporate such modern design features as: DIRECT SPINDLE DRIVE with rapid traverse for raising or lowering the wheel head; FULLY HYDRAULIC TABLE DRIVE providing smooth, positive, instantly variable speeds; MASSIVE CONSTRUCTION insuring permanent accuracy with a correspondingly low operating cost; and VIBRATIONLESS PRECISION that increases production capacity in the grinding of flat surfaces. Hill Vertical Spindle *"Open Side"* Grinders are built in table widths of 18", 24", 30". Standard table lengths range from 5 to 20 feet. *Why not investigate the advantages offered by Hill Surface Grinders?*

ALSO BUILT IN HORIZONTAL SPINDLE DESIGN

The HILL ACME CO.

A consolidation of two nationally known, fifty year old manufacturers:—The Hill Clutch Machine & Foundry Company . . . and The Acme Machinery Company
6400 BREAKWATER AVE., CLEVELAND, OHIO

TO PLANT SUPTS.

This is one of a series of ads addressed primarily to new grinder hands. If you would like additional copies without our signature, for your bulletin board, tell us how many you need.

How to get better and longer service from your grinding wheels...

● The war imposes a double task on industry and a patriotic responsibility on grinder hands. Speed of production has to be increased, without waste of basic materials. With grinding playing such an important part in production, these simple rules may help you do your job better!

1 USE THE RIGHT WHEEL IN THE RIGHT PLACE

Given data on the type of grinding job, the character of metal to be ground, the amount of stock to be removed and the finish desired, a grinding wheel manufacturer can give you a wheel in the right grit, grade, grain, bond, shape and size to meet definitely your grinding conditions—a wheel that will last longer, do better work at reduced grinding costs. And sales engineering service will help you to select the right wheel for every job.

2 MAKE SURE YOUR GRINDING SET-UP IS RIGHT ON EVERY JOB

Manufacturer's recommendations should be carefully followed on wheel speed, work speed, proper coolant, wheel traverse, rate of infeed etc. Only the correct balance of these factors gives you the full advantage of properly specified wheels. One of the services performed by grinding wheel sales engineers is to check your grinding conditions on the job and point out the best method of carrying out the grinding operation.

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

Saved Hours
OF HAND-FINISHING TIME WITH GORTON ON THIS WAR JOB

A FEW GORTON CIRCULAR TABLES ARE AVAILABLE FOR IMMEDIATE DELIVERY—Precision built, for a lifetime of service. Simple, positive adjustments compensate for wear. Table surfaces are accurate within .0005". Work may be indexed to 5 minutes or less. Standard sizes: 10", 12", 15" diameter. For full details write for FREE Accessories Catalog 1317-D.

PRODUCING TOUGH ALLOY STEEL DIES within maintained limits of ±.001" or closer, makes possible a saving of hours of hand finishing. This job and many others like it being turned out by a midwest die and mold manufacturer is a typical example of what can be accomplished with the combination of a Gorton Super-Speed Mill and a Gorton Circular Table, accurate within .0005".

Photo above shows how the die is simply mounted on the circular table. Large micrometer dials on the Gorton Miller and the sensitive "feel" of the machine permit the operator to hold close tolerances with hand feed. Utilizing the Gorton wide range of spindle speeds, these dies are completely machined in 30 hours. Precision milling in this manner produces a finish so smooth that hand finishing is reduced to a minimum.

Gorton Engineers, specializing in Vertical High-Speed Milling, will be glad to make recommendations on your work—without obligation.

HOW TO REPRODUCE ORIGINAL DIES *without Skilled Help*

NOTE—To owners of Gorton Super-Speed Vertical Milling Machines built since 1935—if you have MULTIPLE DIES to REPRODUCE from an original, order a GORTON Duplicating Tracer Head and Duplicating Table to quickly convert your Miller into a double-purpose machine, capable of Duplicating parts and sinking dies, as well as Milling.

This equipment will effect an average time-saving of 50 per cent with *an unskilled man or woman* operator.

SUPER-SPEED MILLING DATA

MACHINE—Gorton Super-Speed Vertical Mill.

PART—Alloy Steel Die.

CUTTERS—Gorton Single and Double Flute Cutters.

DIMENSIONS—1½" Deep to Parting Line.

HOLDING—Simple "T" Slot Clamps.

FEED—Hand.

SPEED—950 RPM.

ACCURACY—Limits held ±.001.

FLOOR-TO-FLOOR TIME—30 hours on Mill to very smooth finish.

WRITE FOR CATALOG 1400-B FREE

giving details on Gorton Super-Speed Vertical Milling Machines.

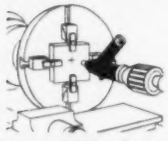
GEORGE GORTON MACHINE CO.

1315 RACINE STREET, RACINE, WISCONSIN, U.S.A.

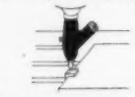
SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

Like the Army's Rangefinder

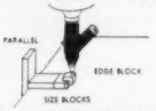
CENTER SCOPE



ON A LATHE—boring, turning or facing from a scribed layout—location accuracy .0001"—*Advantage*—TIME-SAVING!



ON A JIG BORER—ease of locating two edges as "zero points"—*Advantage*—UNFAILING ACCURACY and the ability to repeat set-up within .0001".



ON A VERTICAL MILL—locating and centering from an edge with size blocks—*Advantage*—JIG BORER ACCURACY on more machines.

ON A HORIZONTAL MILL—the ability to center a layout, edge block or rotary table plug while spindle is running. *Advantage*—QUICK AND EASY set-up for high precision work.

IS AN OPTICAL LOCATING AND CENTERING TOOL—THAT CAN BE USED ON ANY MACHINE!

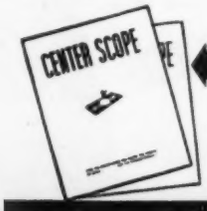
The Army can't afford to miss—that's why it locates and centers its target by means of optics.

The CENTER SCOPE produces the same accuracy in the toolroom—where the cost of a "miss" is also measured in soldiers and material.

The CENTER SCOPE is a *shop tool*—a rugged yet accurate precision measuring instrument with 45x magnification. It's a time-saving, mistake-saving optical instrument that eliminates the human errors in tooling.

With the CENTER SCOPE you CAN *SEE THAT YOU ARE RIGHT!* You can locate edges or layouts to spindle axis 'within a tenth'—you can set-up faster and easier—you can compensate for spindle or adaptor run-out—and you have added confidence to go ahead with machining *at a faster rate!* You can't "miss" with a CENTER SCOPE. Write for complete information—NOW!

CENTER SCOPE INSTRUMENT CO.
351 South La Brea Ave. • Los Angeles, Calif.



FREE OPERATING MANUALS!
1. The CENTER-SCOPE and its Operation.
2. The CENTER-SCOPE and Optics.

AN EYE FOR ACCURACY

CURTIS AIR HOISTS FOR MORE PRODUCTION

Assure Faster, More Efficient Lifting Save Labor, Increase Plant Capacity

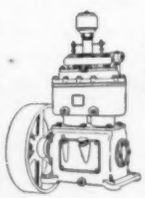
Here's the solution for many a plant faced with today's demand for increased output and a shortage of skilled labor. Curtis One-Man Air-Power Hoists make lifting easier, faster, more efficient—release men for other jobs and reduce manpower fatigue.

Curtis all steel Air Hoists cost no more than a chain block, are smooth in action, speedy, and efficient. They provide extreme accuracy of control and can handle the most delicate hoisting operations. Any workman can operate a Curtis Air Hoist—releasing skilled labor for other duties—for the hoist does the work by air power. Capacities up to 10 tons.

For complete information as to how you can step up production and lower costs in *your* plant, write for free Curtis booklet, "How Air Is Being Used in Your Industry."

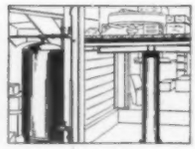
CURTIS ESTABLISHED 1854 ST. LOUIS

Curtis Pneumatic Machinery Division
of Curtis Manufacturing Company
1924 Kienlen Avenue St. Louis, Missouri



Lower your Costs for Air with Curtis Model "C" Compressors (Timken Bearing Equipped)

Reduce Handling Costs with Curtis Hydraulic Lifting Cylinders



A flexible machine that is the last word in simplicity of operation

HI-SPEED
HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"...Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2¾"	2⅞"	2½"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44"x60"	60"x80"	60"x80"	60"x108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

THE VERNON VERTICAL MILL AND JIG BORER
Dial indicators and measuring rods* simplify your measurement problems, permit your operators to mill or bore to split thousandth tolerances . . . produce layouts accurately at one work setting. Batteries of Vernon Vertical Mills and Jig Borers are filling an important place in today's defense program, producing critical small arms parts. See the Vernon today . . . distributed through dealers in all active industrial areas.
Have you received the latest bulletin with detailed description of the Vernon Vertical Mill and Jig Borer? It will be sent upon request. Write today!
*Standard extra
MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON .. LOS ANGELES, CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

Vitrified Wheels

To familiarize you with the complete VITRIFIED LINE . . . . .

All the advantages of economy, long life, accuracy and low cost production are available through standardization on Vitrified Grinding Wheels which are available for every kind of grinding job.

The Vitrified Line includes:

BORITE—for grinding steel of all kinds

CARBORITE—for cast iron, bronze brass and aluminum

SILICATE BONDED—for grinding steel to a fine edge and also for surface grinding

SHELLAC BONDED—for high finish, and also in very thin sizes

RESINOID BONDED—for high speed service in snagding steel and malleable castings, etc., and also for cutting off

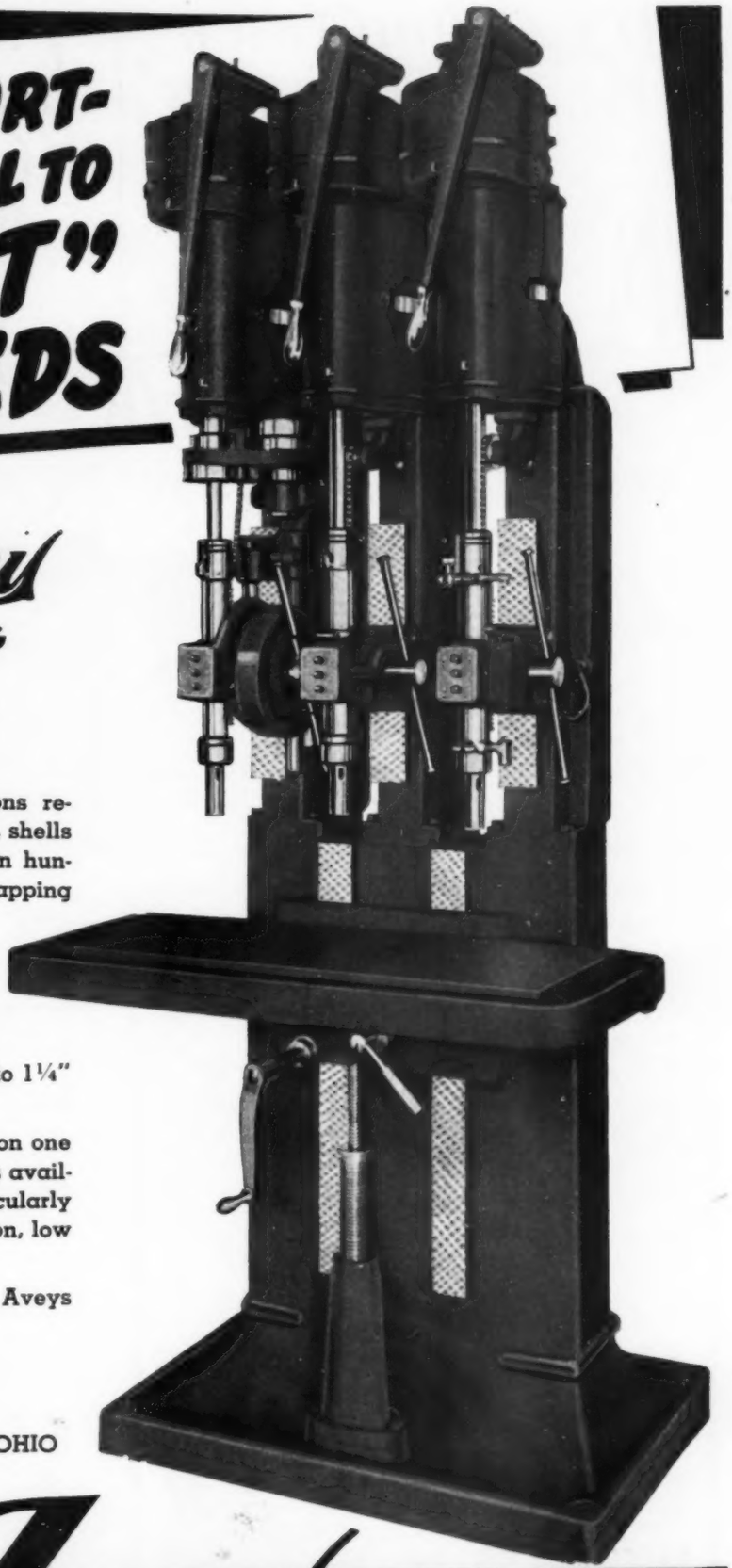
Our representative will gladly recommend the wheel best suited to your grinding requirements. Full details of the Vitrified Line are available in our catalog. Ask for it.

VITRIFIED

VITRIFIED WHEEL COMPANY

WESTFIELD MASS.

TIME IS SHORT-SPEED IS VITAL TO "ALL OUT" WAR NEEDS



Motor-Avey

DRILLING and TAPPING MACHINES SPEED WEAPONS OF WAR TO MANY FRONTS

• Small drilling and tapping operations required on millions upon millions of parts, shells and war munitions are being handled in hundreds of plants on Avey Drilling and Tapping Machines.

Shown is a type MA-6-3 spindle combination Avey—1st spindle, Aveymatic Feed, 2nd spindle, hand feed, 3rd spindle, tapper. Any number of spindles up to six are available in capacities up to 1¼" diameter.

The wide variety of operations possible on one machine—the range of feeds and speeds available—the ease of operation without particularly skilled help make Avey a high production, low cost unit.

Complete details on this and many other Aveys are available. Write for Catalog.

THE AVEY DRILLING MACHINE CO.

CINCINNATI OHIO

Avey DRILLING MACHINES

CINCINNATI · OHIO

IT'S A GOOD TRICK AND WE CAN DO IT!

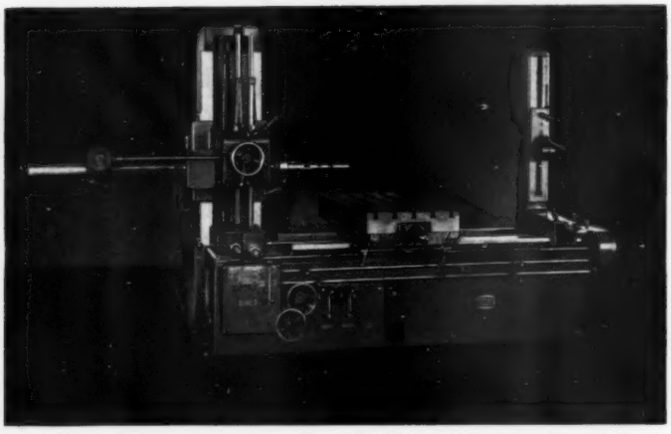
★QUALITY LEVELS LIFTED AND PRODUCTION LINES CURVED UPWARD . . . AT ONE AND THE SAME TIME.

Saves TIME
Saves MAN POWER
Saves SPACE

YODER Nº 3 HORIZONTAL BORING MILL

WE HAVE A FOLDER FOR YOU

Write Now, RIGHT NOW!



The YODER ENGINEERING MANUFACTURING SALES COMPANY
5500 WALWORTH AVE.
CLEVELAND, OHIO

Unskilled Labor can give you high tapping production

on this

Ettco-Emrick FOOT-OPERATED TAPPING MACHINE

The skill needed in tapping is **built into the machine.** All the operator has to do is place the work and step on the pedal. This he can do fast because both hands are free—and with little effort because the pedal is sensitively counterbalanced.

With standard 2-spindle tapping head illustrated, **2400 accurately tapped holes per hour** is easy. With available Ettco-Emrick Multiple Heads, production can be raised to **12,000 holes per hour.**

Write for These Bulletins

BULLETIN NO. 4 tells all about the Machine. **BULLETIN NO. 3** covers the Multiple Tapping Heads. Copies mailed on request.

ETTCO TOOL CO., Inc.

590 Johnson Ave., Brooklyn, N. Y.
Detroit • Chicago

MAKERS OF Ettco-Emrick DRILL CHUCKS • TAP CHUCKS MULTIPLE TAPPING AND DRILLING HEADS TAPPING ATTACHMENTS • TAPPING MACHINES

UNIVERSAL CENTERING CHUCKS AND STANDARD CHUCKS STEP UP ACCURACY—INCREASE SPEED

Above: Universal Centering Chucks convert a drill press into a centering machine. Furnished with a set of bushings and collets for various size center drilling. Accurate and sturdy. Depth adjustment for centers. Write for facts.

Above: Universal Standard Collet Chucks hold tools in a grip as strong as solid steel itself. Nut for spanner wrench. The ideal tool for holding end mills, keyway cutters, drills, etc. Write for facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN

In 3 months one large
manufacturer buys supplies made
by 145
different manufacturers . . from one
local Supply Distributor, who
delivers every item from stock

How are You buying Your Materials?

A prominent Mill-Supply Distributor writes:—"Our big, all-time job is to help War Plants who are our customers to produce faster—by keeping them furnished with equipment and supplies on schedule.

"Just how the Manufacturer can profit by the Jobber's alert, fast-moving service in his behalf is illustrated in the experience of one of our own customers—a Manufacturer we have served for many years. We analyzed our transactions during a typical 3-month period and dug up these impressive facts:—

A—"Materials supplied by us to fill his orders during that 90-day period were produced in *145 different factories.*

B—"Goods from these 145 factories were ordered and paid for by us, and came directly to our warehouse stock.

C—"Deliveries from our warehouse to this customer were nearly always made the same day we received his order."

Depend on it—your Industrial Distributor will use every resource to supply what *you* need. He works in your interest all the time—as we know, because Mill Supply Houses have represented us in selling "Cleveland" High-Speed Twist Drills and Peerless High-Speed Reamers nationwide, for many years.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD., DETROIT · LONDON - E. P. BARRUS, LTD.- 35-36-37 UPPER THAMES ST., E.C.4

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

CARD TAPS

The CARD Quality

ARE YOU INTERESTED IN BETTER TAPPING?

If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

The high quality of work done—the quantity produced—the economy of using Card Taps—will be apparent on any tapping job. Just put Card Taps to work and let them prove their superiority.

A regular catalog tap in most cases will meet your needs without using special taps. You'll find your requirements covered in the Card Catalog No. 34. Write for a copy.

Card taps are sold by leading dealers everywhere

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

STORES: New York: 61 Reade St., Chicago: 11 South Clinton St. Detroit: 6540 Antoine St., Seattle: 568 First Avenue, South Los Angeles: 168 South Central Avenue San Francisco: 121 Second St.

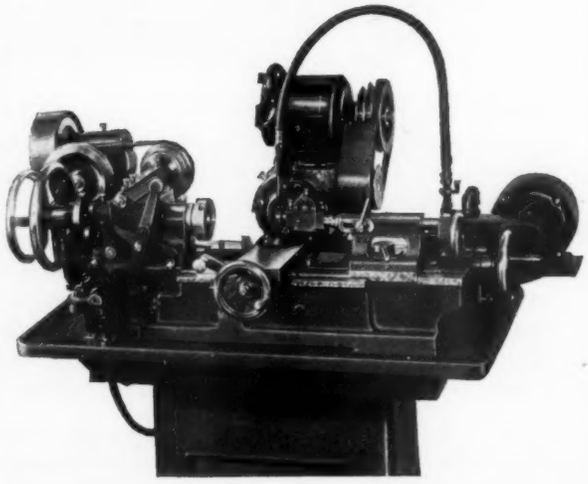
ERRINGTON
STAPLETON, STATEN ISLAND, N. Y.
MULTIPLE HEADS

Super-Sensitive Fixed-Center Multiple Drilling Heads

Fixed-Center Auto-Reverse Multiple Tapping Heads

All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

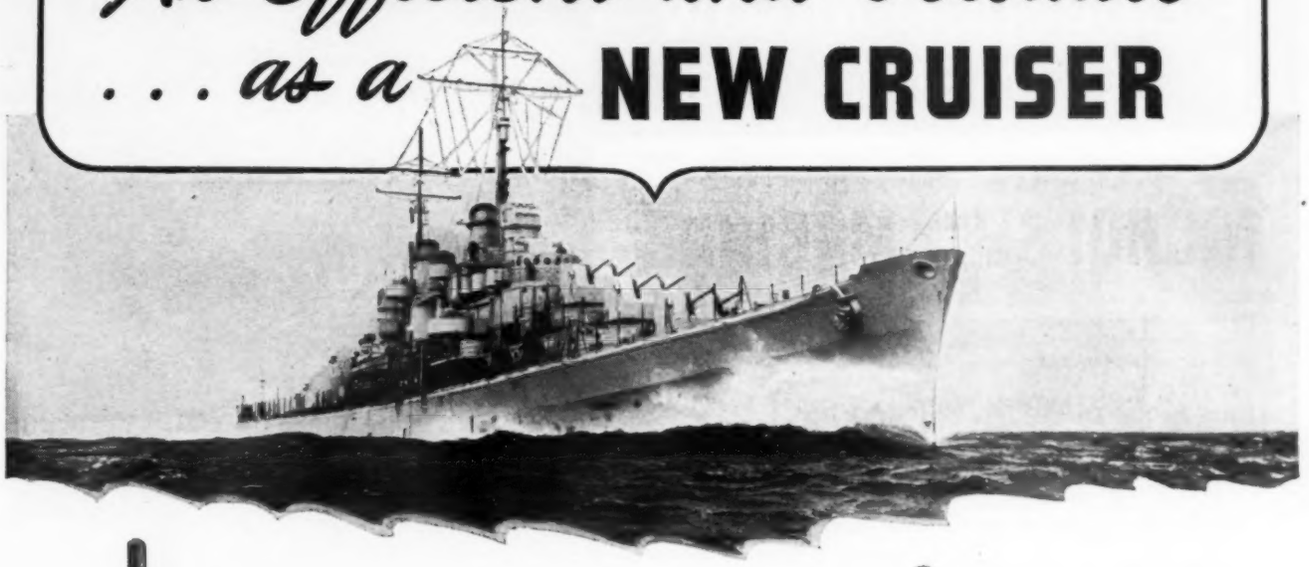


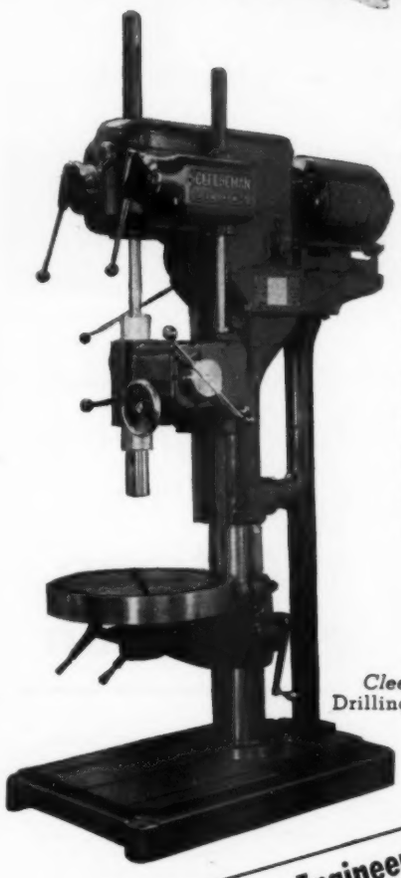
WALTHAM THREAD MILLER
WITH 3 MOTOR DRIVE

A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

WALTHAM MACHINE WORKS
HIGH STREET WALTHAM, MASS.

As Efficient and Versatile . . . as a NEW CRUISER

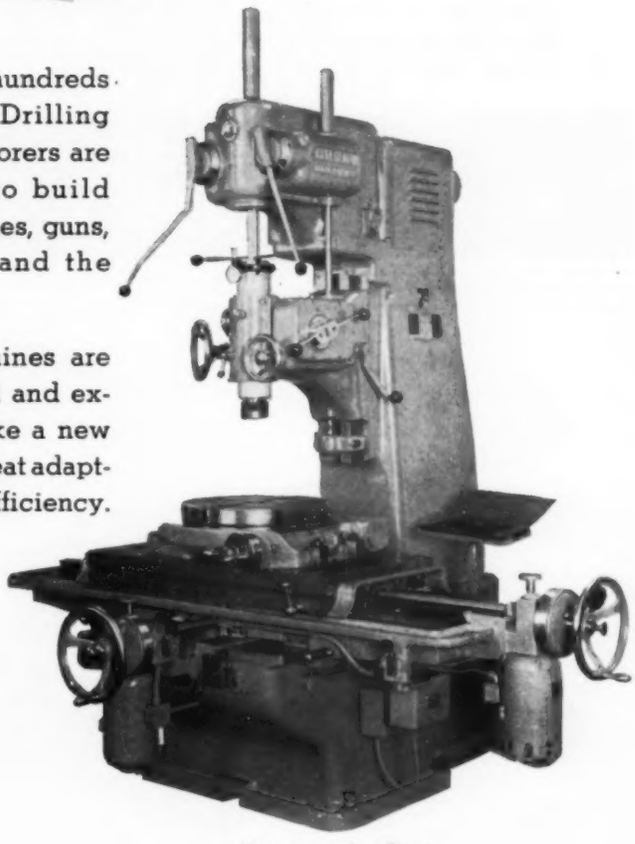




Cleereman Drilling Machine

● Hundreds upon hundreds of CLEEREMAN Drilling Machines and Jig Borers are at work helping to build ships, tanks, airplanes, guns, etc., for America and the United Nations.

CLEEREMAN machines are built for high speed and extreme accuracy. Like a new cruiser they have great adaptability and high efficiency.



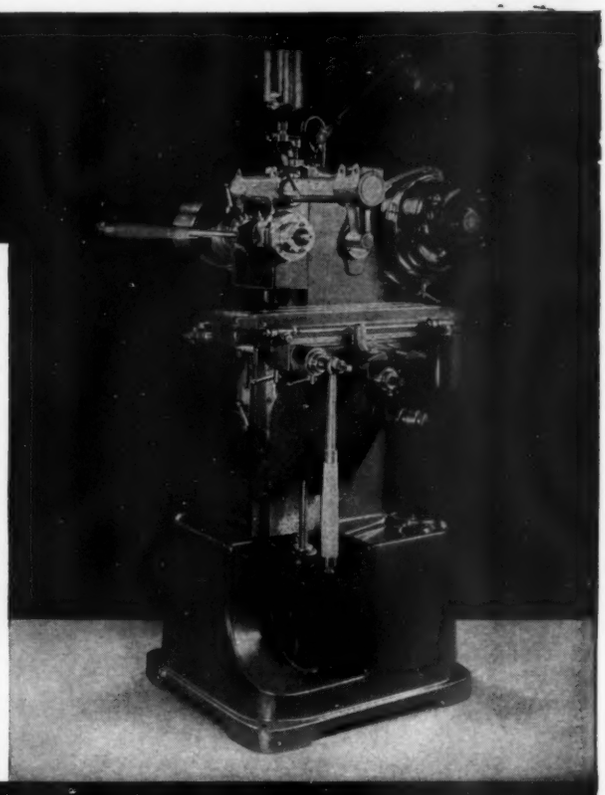
Cleereman Jig Borer

Bryant Machinery & Engineering Company
Sales Division of **Cleereman Machine Tool Co.**
400 W. Madison St. · Chicago, Ill., U. S. A

CLEEREMAN

DRILLING MACHINES and JIG BORERS

★ ★ STEP UP PARTS PRODUCTION AT LOW INVESTMENT COST



. . . with the

NICHOLS HAND MILLING MACHINE

Substantial savings in production milling are assured by the Nichols Hand Miller—a precision machine which combines the usual features of conventional hand millers with the ruggedness and in-built accuracy of modern high production machine tools.

OUTSTANDING FEATURES INCLUDE:

. . . one piece box section column with adequate slides for head and knee integrally cast

. . . heavy box section. Knee with extra long dovetail slides for both vertical adjustment and horizontal traverse

. . . table, fitted with oil pockets at ether end can be operated from either side of machine and locked in any position; standard equipment includes micrometer table stops; table feed screw optional.

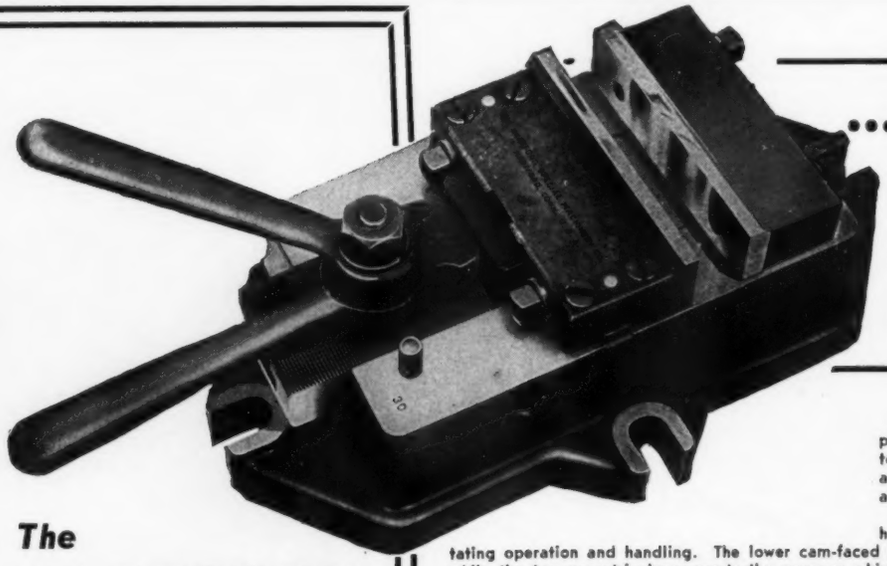
. . . hand operated vertical head fitted with hand set depth stop; can be locked in any position.

. . . spindle hardened and ground mounted on Timken Precision Roller Bearings

. . . capacity: longitudinal feed 10"; traverse feed 7".

» WRITE FOR COMPLETE DETAILED SPECIFICATIONS «

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*



...to help you speed up munitions production

The
HARTFORD
Quick acting
MILLING VISE

SPECIFICATIONS

Width of Jaw—5"
Depth of Jaw—1 3/16"
Max. opening (Plain Jaw)—2⅝"
Max. opening (Swivel Jaw)—2¼"
Weight—40#
Dimensions (Overall) 13" long—8" wide—5" high

Quick action and tremendous holding power are combined in the "Hartford" to meet the urgent need for faster, more accurate work in the manufacture of small arms.

Two levers, easily manipulated by one hand, control all operations thereby facilitating operation and handling. The lower cam-faced lever provides quick opening and return while the top eccentric lever exerts the pressure which holds the work. By releasing the top binding lever and giving the lower lever a quarter turn, work may be instantly released.

On the "Hartford," the movable jaw is in the position ordinarily occupied by the solid jaw on vises of the screw type. This position of the jaw and the fact that the jaw is a single piece drop steel forging makes the "Hartford" vise practically indestructible. A further advantage of "Hartford" construction is the fact that jaw alignment is accurate under all conditions.

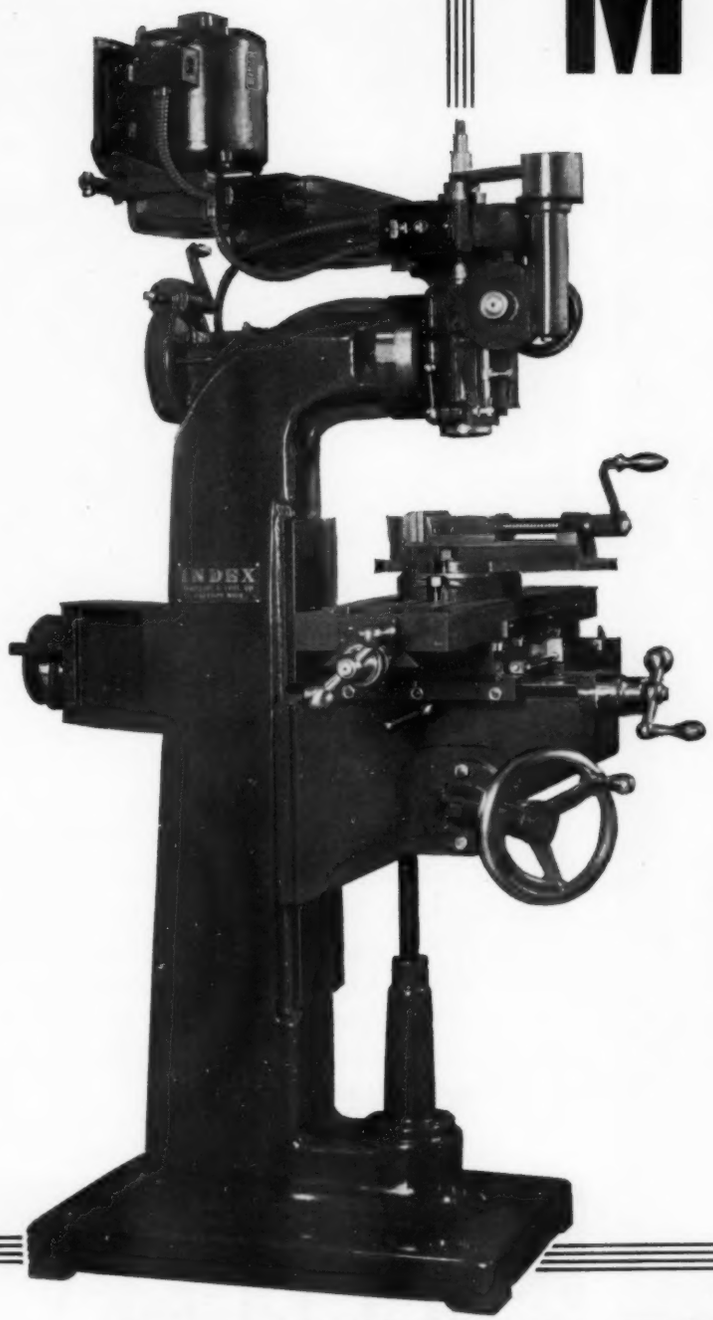
Quick replacement of parts from stock is assured by making all parts interchangeable. Existing false jaws of the No. 2 B&S Vise are interchangeable with those used on the "Hartford."

Made in Plain and Swivel Jaw types.

Investigate Immediately!

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD CONNECTICUT

INDEX MILLS



. . . are attacking mountains of munitions parts with the ferocity of a mosquito boat after an enemy fleet. They are very versatile and are quickly adaptable to production work on the thousands of small precision parts now so vital to our Victory Program.

. . . do end mill work with end mills up to 5/8" in tool steel with amazing speed and accuracy.

. . . will bore a 3" hole in steel.

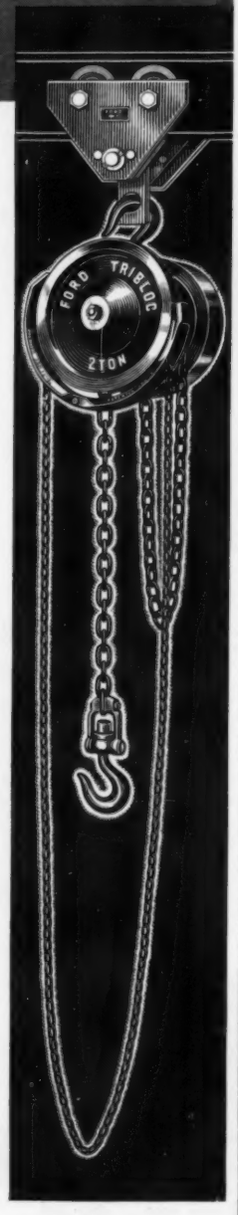
. . . are equipped with verniers for locating holes and milled surfaces.

. . . have a spindle running in super precision preloaded ball bearings and guaranteed to give ordinary service for a year without any attention.

WRITE TODAY FOR FOLDER AND QUOTATION.

BLANK & BUXTON
MACHINERY CO.
3106 E. MICHIGAN AVE. JACKSON, MICH.

8 ways to keep your FORD Triblocs rolling for the duration



Because steel is so critical to America now, it is up to every one of us to make our present equipment last longer. That means proper maintenance. Here are **8** things to do to keep your **FORD TRIBLOCS** in efficient working order:

1. **Keep equipment well lubricated and in good repair.**
2. **Don't exceed rated capacity.**
3. **Inspect chain periodically and change when wear becomes excessive.**
4. **Don't make lifts or pulls for which hoist was not designed or intended.**
5. **Avoid dropping hoists or throwing chain carelessly.**
6. **Replace straightened hooks.**
7. **Be sure the hoist has the capacity and characteristics necessary for the job.**
8. **Proper hoist selection saves production time and lengthens hoist life.**

Write for information on **FORD TRIBLOCS.** They range in capacities from ¼ ton to 40 tons. They are available to all who have adequate priority rating.

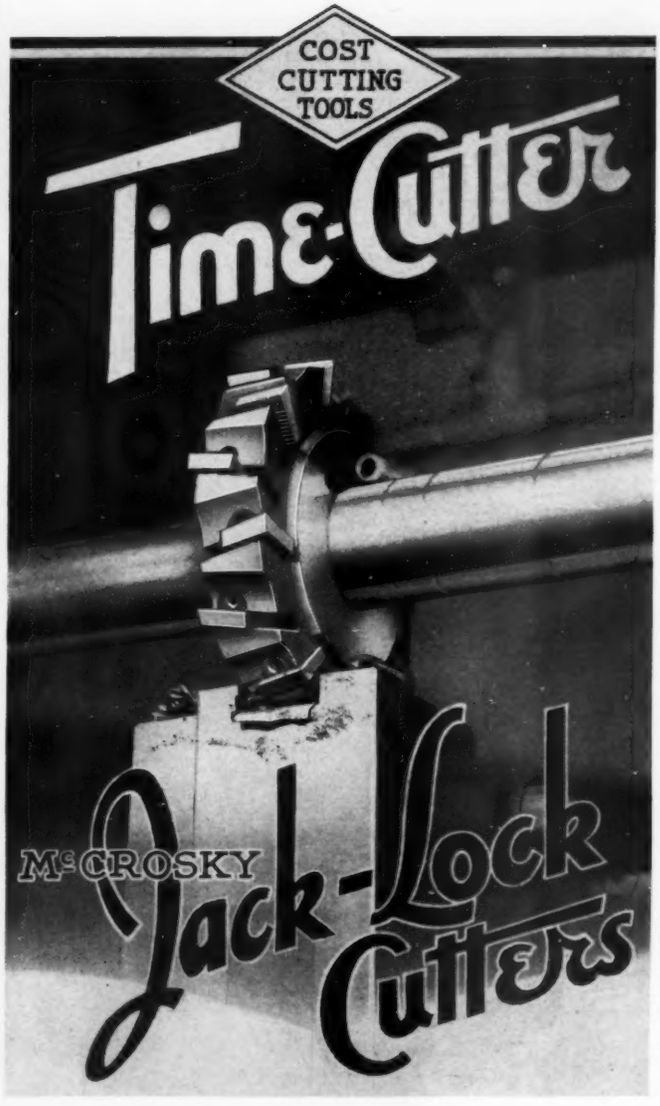
Order from your distributor

FORD CHAIN BLOCK DIVISION

PHILADELPHIA • CHICAGO
SAN FRANCISCO

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT, CONNECTICUT



ENGINEERED into McCrosky JACK-LOCK Staggered-Tooth Cutters are longer blade life, shorter down-time. McCrosky JACK-LOCK Wedges lock and unlock without hammering. McCrosky Adjusting Screws minimize blade stock removal in resharpening. McCrosky Tru-Ground Serrations mean greater rigidity at high speeds. Ask for McCROSKY BULLETIN 15-M.

EST. 1904
McCROSKY TOOL CORPORATION
MEADVILLE, PA.

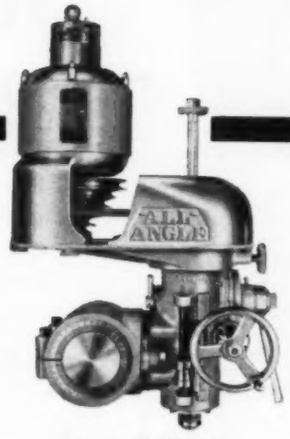
All the Flexibility of a Rubber Hose

FRAY

"All-Angle" Milling Machines and Attachments

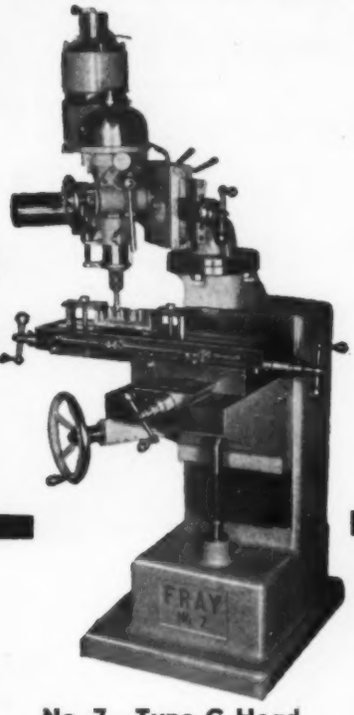
No. 7-B Ram Type

Cross movement of Head above work — as well as longitudinal movement — gives complete range of operations with *one set-up.*



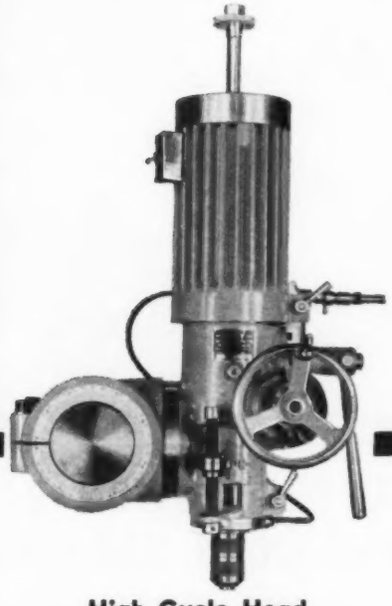
Type D Head

Motor swings completely around housing and can be locked at any point. Micrometer wheel feed or hand feed. Positive quill lock.



No. 7—Type C Head

Full universal, quill type machine. . . . Hand wheel feed calibrated in 1/1000". Hand lever feed, micrometer depth stop, clear vision graduations on quill.



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For high speed production on Dural and Aluminum Alloys . . . cutter speeds as high as 10,000 lineal feet per minute. Adapted to Types A, B and C Heads.

Type C Head

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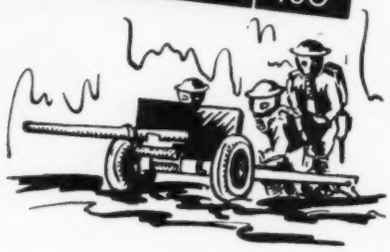
	KENNAMETAL	OTHER CARBIDE
PIECES PER TOOL GRIND	40	15
GRINDS PER TOOL	12	12
PIECES PER TOOL	480	180



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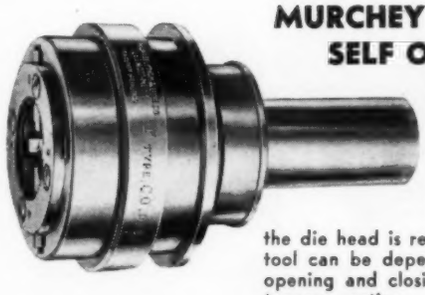

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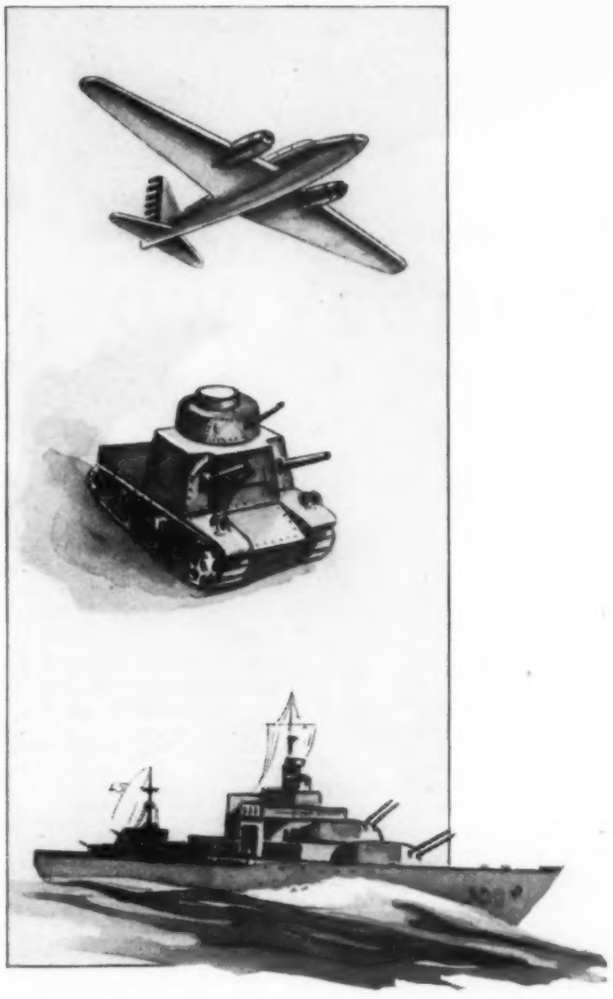

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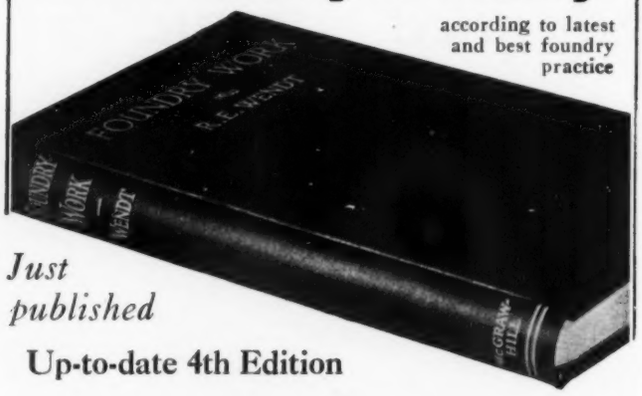

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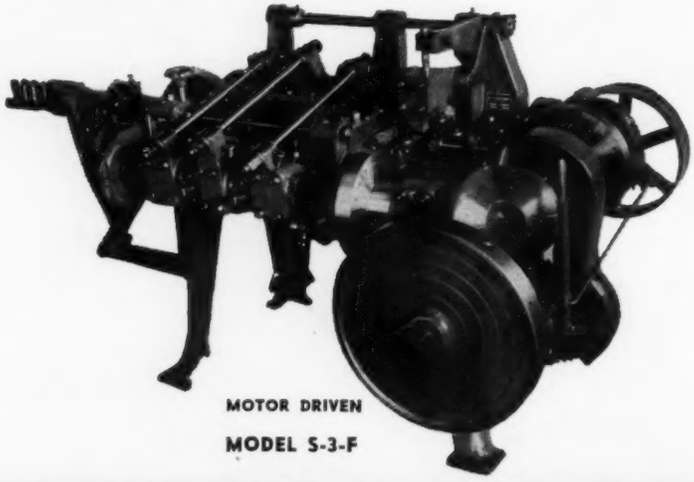

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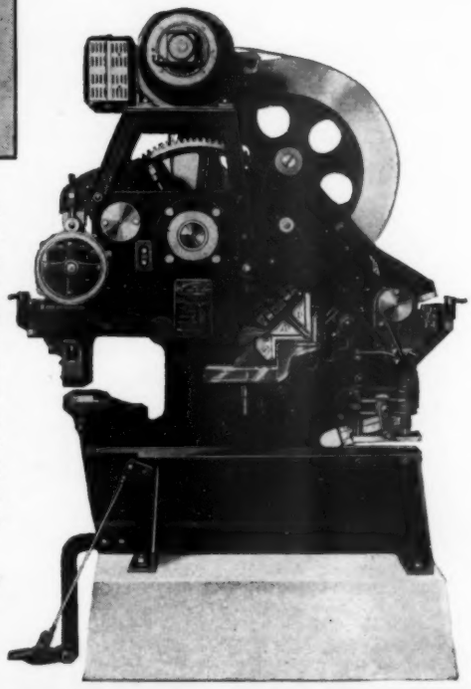

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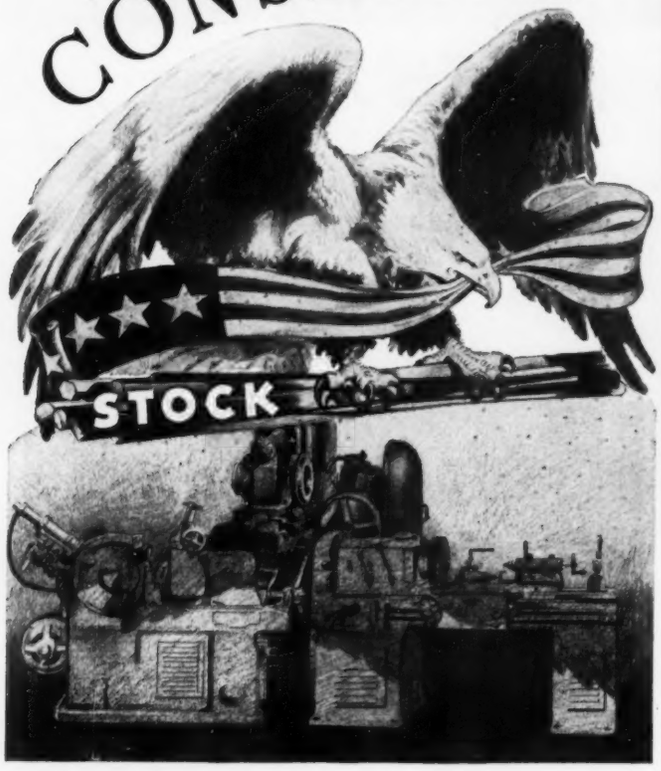

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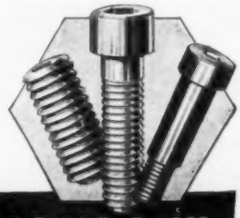

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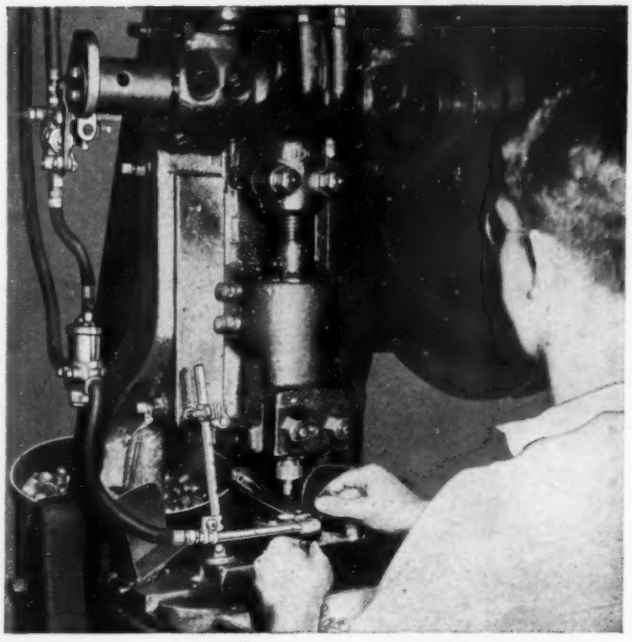

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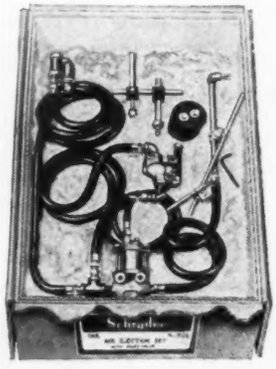

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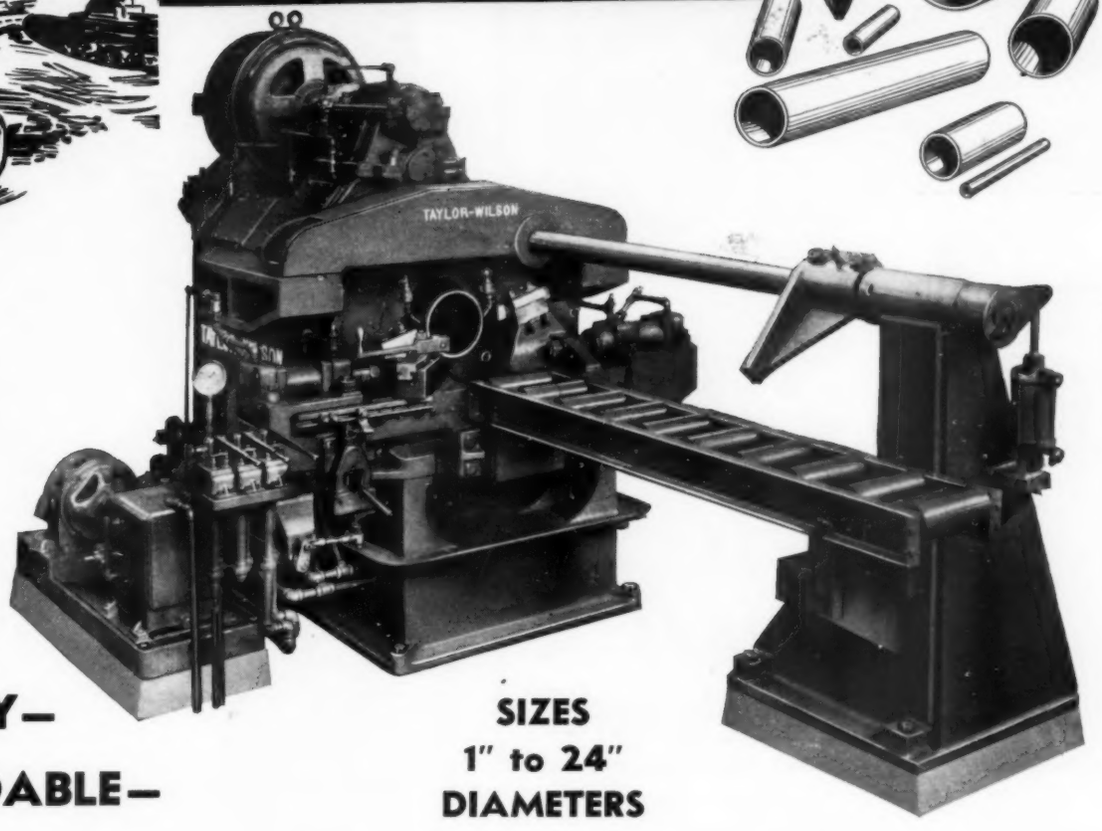

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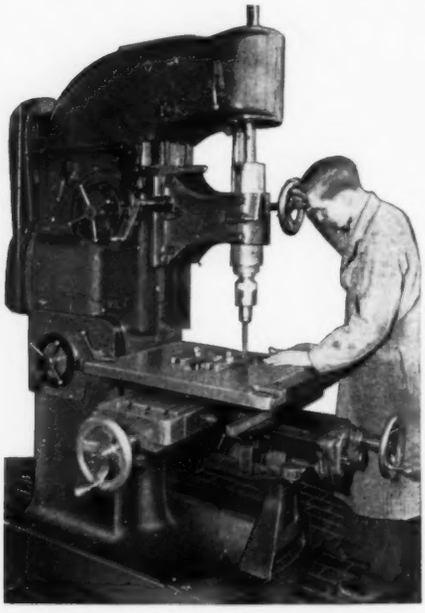

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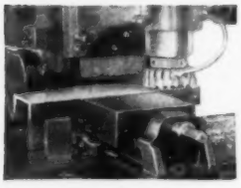
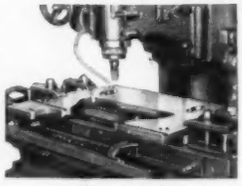
Dial indicators for quick and accurate locating, a large accurately fitted spindle to insure round and straight holes, and table slides that are square, make KNIGHT Millers exceptionally valuable in precision boring.

The table may be tilted to either side of horizontal besides swiveling around the column. The advantage of this feature is emphasized where an angular surface is being machined without special equipment—the work is simply bolted flat on the table. This feature eliminates the need of many special fixtures and shortens the set-up time on such work. The degree to which the table is tilted is set by a graduated segment on the right side of the knee.

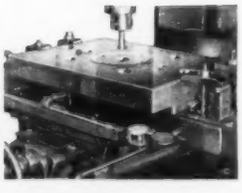


Timken mounted spindle and accurately fitted rigid table furnish power and accuracy for this face milling cut.



Ease of operation, quickly changed cutters, quick reading dials provide for efficient milling operations on this 20"x25" steel plate.

Power and rigidity permit heavy milling like taking 1/8" off the 5" face of steel forgings by a 2"x6" helical cutter.



Boring operations on this 29"x18" plate get accuracy and speed from dial indicators, accurate spindle and square table slides.

Write for New Catalog NOW - -

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

Precision

The precision with which a fighting plane roars through the sky has its beginning in thousands of plants turning out many small parts, accurately machined to exact measurements.

Many parts for war planes flow through the Fenn Plant, where long years of building special machinery have given them a sound knowledge of design and production.

When the war planes have been swept from the skies, and Victory is ours, Fenn will take up again the manufacture of production machinery.

Keep the name Fenn in mind for machines and tools, design and development, when that time comes.

FENN

THE FENN MANUFACTURING CO.

HARTFORD, CONNECTICUT • ESTABLISHED 1900

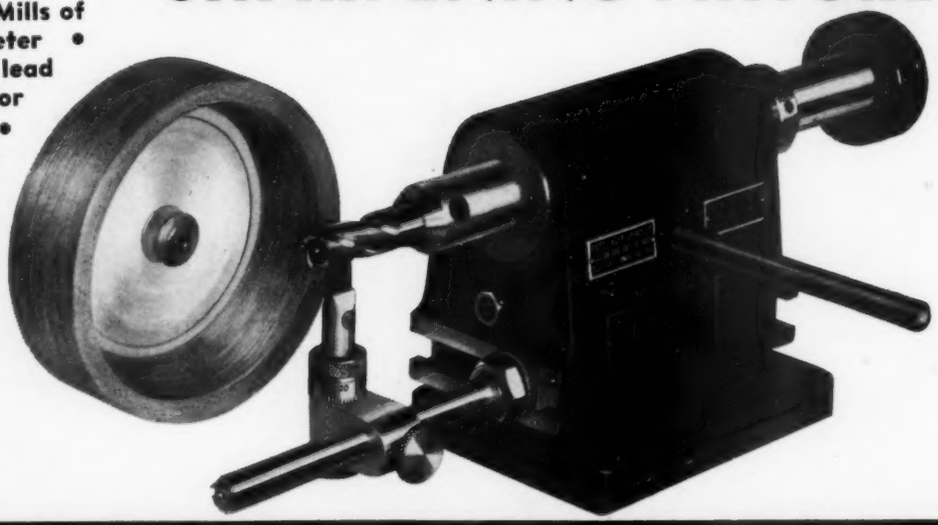
END MILLS ARE SCARCE...MAKE 'EM LAST

Use your WELDON SHARPENING FIXTURE

COMPLETE!
SELF-CONTAINED!

Quickly re-sharpens End Mills of ⅜" to 1¼" shank diameter • Requires no centers or lead cams • Releases major production equipment • Designed for any grinder with flat table • No table movement necessary • Operated by trained or unskilled workers • Provides tool conservation — a vital war factor.

SIMPLE!
CONVENIENT!
FLEXIBLE!



THE WELDON TOOL CO.
3002 WOODHILL ROAD • CLEVELAND, OHIO
"Yesterday's Pioneer — Today's Leader"

END MILLS • GROUND CIRCULAR AND FLAT FORM TOOLS • SCREW MACHINE CAMS • "TU-LIP" COUNTERBORES

Speed up Your Production!

HANDLE YOUR CUTTING-OFF OPERATIONS (3" and larger) ON THIS NEW MACHINE . . . . .

The Porter-McLeod Cold Metal Sawing Machine will definitely step-up your production and quickly pay for itself when you have to cut stock 3 inches and up.

An outstanding production cutting-off machine, with modern enclosed motor drive and centralized controls, the new 8" Porter-McLeod will handle single pieces or permit nesting of bars or shapes for cutting off multiple units simultaneously.

Feed of blade upward to the stock provides blade protection against riding or bumping. Support of blade near its rim prevents buckling and maintains accuracy of cutting. By pulling blades through the cut, large size stock can be cut with less power and with assurance of a straight cut. Standard feed of the machine is 3 inches per minute and is made by means of a friction disc which insures against blade breakage especially when coming in contact with hard spots in the stock being cut. Feed can be increased for cutting brass and other non-ferrous metals.

Regardless of the material to be cut, you can depend on this machine for the utmost in productive capacity, economy and speed.

The machine is driven by a 5 H.P. 1800 R.P.M. motor and is equipped with magnetic switch and push-button station. Detailed specifications available on request.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

These Low-Cost METAL-CUTTING BAND SAWS Can Help You *Right NOW*

When you are confronted with an urgent need for immediate increased production in connection with the U. S. armament program — check into the possibilities of using this 14-inch Delta metal-cutting band saw. It is ideal for cutting

- Aluminum Castings
- Aluminum Sheets
- Hard Cast Brass
- Soft Cast Brass
- Brass Sheets
- Brass Tubing
- Cast Iron
- Copper
- Metallic Hose
- Cold Rolled Steel
- Carbon Tool Steel
- Bronze & Manganese
- Drill Rods
- High Speed Steel
- Monel Metal
- Nickel Steel
- Iron Sheets & Bars
- Pipe
- Malleable Iron
- Babbitt
- Bakelite & Molded Plastics
- Asbestos & Felt
- Brake Linings
- Fibre & Mica
- Slate & Transite
- Hard Rubber

Will Help Speed up Production

There is no limit to the number of jobs you can find for this economical low-cost tool around the general tool and machine shop. And the few uses mentioned above scratch only the surface of the machine's adaptability. Die casters and molders of plastics find it indispensable for trimming work. The miter-gage groove in the table makes it easy to fit the machine with fixtures for cutting tubing, etc., on a production basis, and it can be fitted with rip gage for cutting strips from sheet metal. Once the machine is installed, there is no end to the number of jobs that are found for it!

Many Basic Advantages

This machine is not just another metal-cutting saw—but represents sound designing from the bottom up with many new basic features. Double trunnions provide rigid table mounting. Fully enclosed gear-drive, running in oil, is mounted directly on base of machine. Four metal-working speeds. Can be switched easily into high speed for soft materials. All wheels and shafts are carried on New Departure self-sealed ball bearings, insuring trouble-free performance for the entire life of the bearings. The guides, unlike those in ordinary machines, adjust independently of each other, are made with micrometer accuracy; and provide smooth, clean, accurate cutting.

OTHER DELTA LOW-COST MACHINES

Cut-Off Machine cuts speedily and to exact lengths a wide variety of materials. Priced at one half the usual cost of machines of this type.

A complete line of single and multiple spindle 14" and 17" drill presses in slow and high speed models.

Bench and Pedestal Grinders "that never forget their goggles"—the safest, most accurate and efficient grinders made.

Send for CATALOG

Send coupon below for latest Delta catalog giving full specifications and prices of Delta 14-inch Metal-Cutting Band Saw. Also prices and details on the complete line of Delta low-cost machines.

DELTA
MILWAUKEE

No. 887-C—
Metal-Cutting
Band Saw

THE DELTA MANUFACTURING COMPANY
608-G E. Vienna Avenue, Milwaukee, Wis.

Please send me catalog of Delta Machines, giving specifications and prices on Delta Metal-Cutting Band Saws. I am also interested in ☐ Delta Cut-Off Machines ☐ Delta Drill Presses ☐ Delta Grinders ☐ Delta Power Feed Drill Presses.

Name .....

Address .....

Victory is in his Eyes!

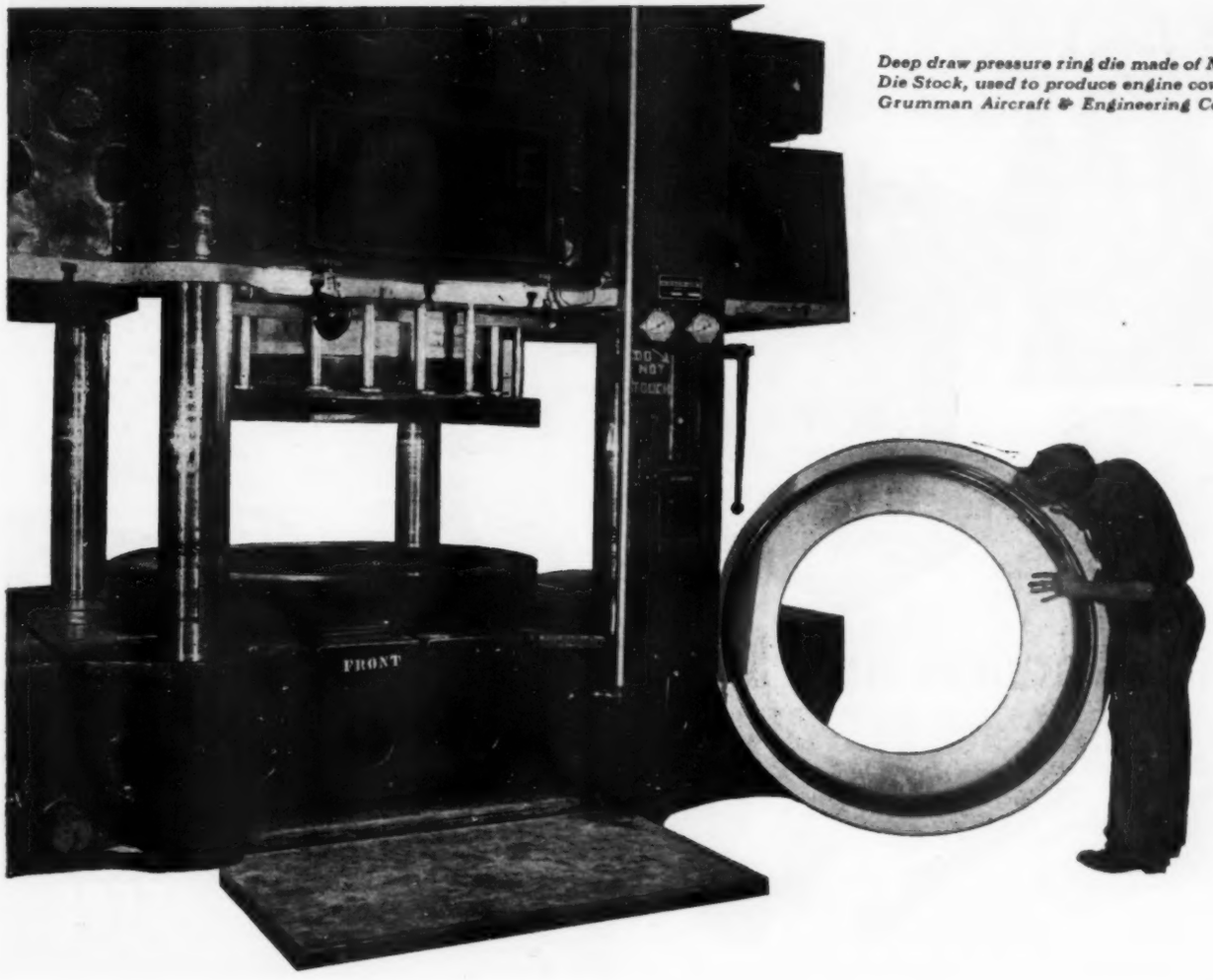
...PROTECT THEM WITH AMERICAN OPTICAL GOGGLES

He is the trained industrial worker. How fast and well we equip our fighting men depends upon his skill — and his skill is lost without his eyes. *Protect* his eyes from major or minor injury... the kind that in 1940 and 1941 robbed America of nearly 20,000,000 invaluable man-days for the production of our war supplies.

American Optical Company offers a complete line of Goggles to help the Arsenal of Democracy reach the highest peak of production. Each AO Goggle has been scientifically designed for comfort and protection against a specific type of eye hazard. Call in your AO Safety Representative today.

THE American Optical COMPANY

SOUTHBRIDGE MASSACHUSETTS



Deep draw pressure ring die made of Masonite Die Stock, used to produce engine cowlings at Grumman Aircraft & Engineering Company.

Short on Worry, Long on Wear

YOU don't have to worry about shrinkage, cracking, twisting or warping when you use Masonite* Die Stock for deep draw pressure ring dies. And you don't have to keep reworking your dies, either. They can be used almost indefinitely.

This new, semi-plastic material is without cross or end grain. It can be worked with metal or wood hand tools or power machines.

Because of its light weight and high compressive strength—because it saves so much precious time and cuts down production costs—Masonite Die Stock is a prime favorite today with aircraft builders.

It is being used also in conjunction with rubber pads for shearing, forming, and shearing and forming in one operation, router templates, drill jigs and assembly fixtures. It can be laminated to the desired thickness for spinning chucks.

Available in thicknesses of ¼ to 2 inches . . . in sizes of 48 x 72 inches and 48 x 144 inches. For full details, mail coupon below.

*TRADE-MARK REG. U. S. PAT. OFF. "MASONITE" IDENTIFIES ALL PRODUCTS MARKETED BY MASONITE CORPORATION. COPYRIGHT 1942, MASONITE CORP.

MASONITE CORPORATION, *Dept. AM-7,* **111 W. Washington St., Chicago, Ill.**

Please send me illustrative literature and complete information about Masonite Die Stock.

Name and firm _____

Address _____

City _____ *State* _____

Producing stamped parts Faster - Better Cheaper

Airplane strut seat of .031" brass produced complete one per stroke at new high rate.

Dieing Machines Help Keep 'em FLYING and SHOOTING!

INCLUDING BROACHING

Of various cartridge clips produced on Dieing Machines, this one is for caliber .303 rifle produced from flat material complete one per stroke at exceptionally high rate.

Airplane fuselage hingle of duralumin produced complete per stroke in continuous strip to precision limits including BROACHING operation.

Machine gun belt link produced complete one per stroke to extreme precision limits at exceptionally high speed.

Reaching new highs in production of precision stampings, the Dieing Machine is helping our 'planes reach new highs in efficiency of operation and fire-power. Dieing Machines produce COMPLETE PER STROKE numerous intricate items for airplane fuselage, engine and instrument components, holding the stamped product within limits of .0002" when required. In addition, these automatic presses produce most of the machine gun belt links, plus a wide variety of munitions items which may require 8 or more operations of blanking, piercing, forming, drawing, coining, extruding, broaching—all combined COMPLETE PER STROKE. Capacities: 10 tons to 300 tons.

Intricate stampings complete per stroke

STAMPINGS

- Airplane instrument, engine and fuselage parts
- Mechanical time and contact fuse parts
- Rifle components
- Cartridge clips, or rifle chargers
- Gas mask stampings
- Ammunition stampings
- Bomb components
- Shell parts
- Detonator stampings

OPERATIONS

- Bullet assembling
- Primer inserting
- Automatic time and contact fuse assemblies

Request Catalog 42

THE HENRY & WRIGHT MFG. CO.

485 Windsor St. Hartford, Conn.

Henry & Wright Dieing Machines

DON'T DELAY THE VICTORY

SPEED PRESS ROOM OPERATIONS WITH FEDERAL DIAL FEEDS

Don't delay victory by using incompetent press equipment! *Speed up* many primary and secondary operations *three to six times* by using Federal precision-built presses with multiple dial feeds. Positive indexing and locking mechanism smooths out dial action—assuring unusually rapid production, exceptional accuracy and safety to operator. Easily indexed to any part of the crankshaft revolution from 90° to 180°, giving long or short dwell of the dial. Cannot skip or coast by stations. All moving parts are enclosed. Automatic loading and ejector mechanisms can also be furnished if desired. And dial feeds are available in eight sizes of Federal Presses. Write for facts today; no obligation.

A FEW OF THE COMPANIES WHICH ARE SPEEDING PRODUCTION WITH FEDERAL DIAL FEED PRESSES

General Electric Co. Wheeling Steel Co. B. F. Goodrich Co.
Bendix Products Co. General Tire & Rubber Co.
Ohio Rubber Co. C. G. Conn, Ltd. P. R. Mallory Co.
Fulton Sylphon Co. Barnes Gibson Raymond Co.
Firestone Tire and Rubber Co.

THE FEDERAL PRESS CO.

607 Division St., Elkhart, Ind.

MANY FEDERAL MODELS

Federal Open-Back, Inclinable Presses are available in nine sizes, with capacities ranging from six to 80 tons — either flywheel or geared type. They represent the culmination of Federal's 40 years' intensive experience in press building.

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

PRIME CONTRACTOR OFFERS SUB-CONTRACT WORK

Products wanted: steel castings, forgings, and machining. Submit inventory of plant and machinery.

LEONARD TROSKIN
67 West 44th St. New York City

WORK WANTED FOR

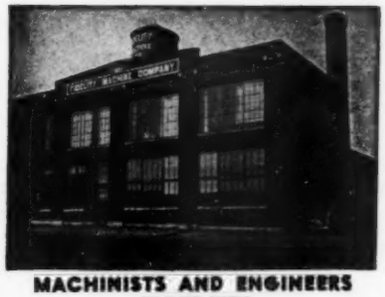
Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.

HAIDA ENGINEERING CO.
34-11 Vernon Blvd. Long Island City, N. Y.

Need steel balls for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.

ABBOTT BEARING BALLS



MACHINISTS AND ENGINEERS
FIDELITY MACHINE COMPANY
3908-18 Frankford Ave. Phila., Pa.
Jefferson 7600-1-2

QUALITY
SCREW MACHINE PRODUCTS

WALTHAM
SCREW COMPANY
WALTHAM • MASS.

SUBCONTRACTS WANTED

— Parts and Pieces — Complete Assemblies —

34 Automatic Screw Machines—Secondary Equipment: Milling, Drilling, Tapping, Threading—39 Punch Presses—Tool Room (well equipped) —Finishing: Parkerizing, Electroplating, Lacquering, Tumbling, Sand Blasting, Polishing, Buffing.

Write for Complete Facilities List

NATIONAL BRASS CO. GRAND RAPIDS MICHIGAN

SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .
exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples *today* for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

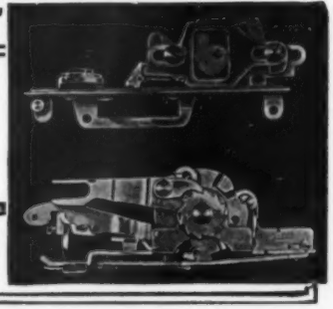
STAMPINGS AND ASSEMBLIES

"GREATER SAVINGS WITH GREIST"

We can make short or long runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. We are also fully equipped to make

SCREW MACHINE PRODUCTS
TOOLS, DIES, JIGS, FIXTURES

Quality work by skilled mechanics is assured. Send your blueprints or samples today!



THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

PUNCHINGS
STAMPINGS
ASSEMBLIES

Quick action on your problem! Use our manufacturing facilities as your branch factory. Well-equipped for small and medium-sized work. Investigate time-saving possibilities *today!* Send prints or samples.

M & M MANUFACTURING CORP.
FORTVILLE, INDIANA

WAR CONTRACTORS

Use your plant facilities to the utmost by improved material and product handling methods. Consult SEDGWICK for engineering advice on elevators, dumb waiters and hoists to solve vertical transportation problems.

SEDGWICK MACHINE WORKS
166 West 15th St. New York, N. Y.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy

SPECIAL MACHINERY

CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

DESIGNERS OF
• TOOLS, JIGS, FIXTURES
• SPECIAL MACHINERY
ORDNANCE WORK A SPECIALTY

OLD COLONY ENGINEERING CO.
180 WEEDEN ST. PAWTUCKET, R. I.

DESIGN & BUILD
JIGS, FIXTURES & GAGES

REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service

LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria Virginia

COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories

AGERSTRAND CORPORATION
Muskegon, Michigan

GEST ENGINEERING & EQUIPMENT CO.
Ordnance and Defense Plant Equipment
Industrial Engineers
Jigs, Fixtures, Gages and Special Mach.
31 East, Georgia St. Indianapolis, Ind.

KIRK & BLUM
WELDED MACHINE BASES, PEDESTALS and FRAMES
LATHE PANS
GEAR and BELT GUARDS
Pressed Steel Louver Panels and Cover Plates

THE KIRK & BLUM MFG. CO.
2823 Spring Grove Ave., Cincinnati, Ohio

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING

THOMAS & SKINNER STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

MACHINE SHOP
Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO.
HOCKESSIN DELAWARE

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

MACHINE SHOP WANTS DEFENSE WORK
Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.

STEPHEN J. LEWIS ENGINEERING CO.
215 Butler St. Triangle 5-5348 Brooklyn, N. Y.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.

GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

YOUR SHORT CUT TO WAR SUB-CONTRACTS

American Machinist sends your advertising message to over 22,000 paid subscribers. These are the men who control over 90% of the buying power of Metal-Working. It is your "Open Sesame" to doors barring your way to profitable sub-contracts. *Try* the method that has worked for others! You will be pleasantly surprised at its low cost. For complete information at no obligation, write,

CONTRACT WORK DEPARTMENT

AMERICAN MACHINIST 330 W. 42nd St., NEW YORK, N. Y.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rates is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

(Copy for new advertisements received by July 13th will appear in July 23rd issue subject to space limitations)

PRODUCTION CONTROL SUPERINTENDENT

Graduate engineer or equivalent with executive manufacturing and practical experience with ability to supervise all phases of production control.

METHODS SUPERVISOR

An outstanding opportunity for experienced Methods Supervisor. Must have ability and practical experience in machine tool, electric wiring, and light assemblies.

These are permanent positions with liberal salaries in an organization with large war orders as well as post war plans. Plant located in the East. Write giving full personal history, experience and present salary; personal interview will be arranged later. We do not desire applications from men in key defense positions.

P-275, American Machinist

330 W. 42 St., New York City

WANTED

GEAR SPECIALIST

possessing thorough knowledge of gear theory as well as shop practices pertaining to manufacture of hardened ground, high quality gears.
Apply by letter to Personnel Administrator, Inspection Department, Pratt & Whitney Aircraft, East Hartford, Connecticut.

TOOL MFG. PLANT

Small-medium size tools: well known: Daylight bldg. 36x150: Modern equipped: 30 machines: Heat treating-forging furnaces: est. 21 years: Cleveland area: sell complete $30000 Details

THE APPLE CO. *Industrial Brokers*
Established 1905 Cleveland, Ohio

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

WANTED

MACHINE TOOL DESIGNER

One of the finest equipped plants in the Metropolitan District requires a machine tool designer of the highest type; one who has proven ability in creative work and initiative. This is a rare opportunity for the right man. No letter considered that does not give complete details of background. Starting salary $10,000.

P-240, American Machinist
330 W. 42nd St., New York, N. Y.

"TECHNICAL ABILITY and MANPOWER"
to do your
Electrical and Mechanical Designing!
Complete Plan Preparation—Specifications
Estimates—Installation Supervision
Industrial Plant Planning
Layouts—Production Systems, etc.
Ample Facilities—Maintained Schedules
Write—Wire or Phone
Equipment Engineering Associates
Telephone—ANDover: 3420-21
64 W. Randolph St. CHICAGO, Ill.

PROFESSIONAL SERVICES

MORRIS AND VAN WORMER
Est. 1924
Production Engineers
WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
25 Broad Street New York City

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

METALLURGIST: One familiar with shell steels for employment in defense plant. P-277, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc. 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

PROJECT ENGINEER—experienced in product design, production and tooling. Capable of following through from idea to finished product on new developments. Employed, American citizen, University graduate, family man in early thirties. PW-271, American Machinist, 330 W. 42nd St., New York, N. Y.

FACTORY MANAGER or Superintendent, Technical Graduate, 22 years experience supervising production, development and design, progressive manufacturing and assembly of medium and small parts, tool and process engineer, desires connection of responsibility. PW-281, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results, Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

PATENT ATTORNEY, CONSULTING ENG'R, Over twenty years engineering experience with patents. Confidential, Personal Service. David Manly Heller, 134 North LaSalle, Chicago.

WANTED

GRINDING WHEEL ENGINEER

A medium sized company, established over 30 years, ably managed, strongly financed and highly regarded, has attractive opportunity for just the right man.

Must qualify to take executive responsibility in charge of the Vitrified Grinding Wheel department. Preference for College Graduate, 32 to 45, with extensive experience in vitrified wheels including—manufacturing, research and development, specifications, sales and service work. Good salary and bonus, permanent association, future only limited by man's own capacity.
Do not apply unless fully competent to handle men—and a big job. Give complete information—your confidence will be respected.

P-278, American Machinist
330 West 42nd St., New York City

WORKS MANAGER

Excellent opening for high grade manufacturing executive with midwest metal products plant with background of 50 years successful operations. Several thousand employees. Permanent position. Desire man with college education, under 45 years of age. Earning over $7,000 now. Replies should include experience details, personal qualifications, marital status, etc. Enclose snapshot. Confidential. Address

P-274, American Machinist,
520 N. Michigan Ave., Chicago, Ill.

Auction & Equipment Wanted Advertising—See Page 211

KEEP 'EM RUNNING!

REBUILT AND READY to SHIP

1—20" SELLERS slotter M.D. with 3/60/220 V motor.

1—4" BIGNALL - KEELER pipe machine, M.D. with 3/60/440 V motor

1—24" INGERSOLL cutter grinder, M.D. with 3/60/440 V motor

1—No. 1 MANVILLE cold header, single pulley drive

1—No. 1 CAMPBELL nibbling machine, M.D. with 3/60/220 V motor

• ALSO AVAILABLE

#9 NILES - BEMENT - POND HD Vert. Millers

#10 NILES - BEMENT - POND HD Vert. Millers

30" x 30" x 10' NEWTON Horiz. Slab Millers

24" GOULD-EBERHARDT Gear Cutter

#3-H BROWN-SHARPE Automatic Gear Cutters

#4—36" BROWN-SHARPE Gear Cutter

50" x 8" GOULD-EBERHARDT Spur & Bevel Gear Cutter

#5—60" BROWN-SHARPE Gear Cutter

64" x 20" G & E Spur Gear Cutter with Internal Attm't

90" PRATT - WHITNEY Spur & Worm Gear Cutter

22" RHENANIA Hobber

15" GLEASON Bevel Gear Generator

24" GLEASON Bevel Gear Planer

ALL MOTOR DRIVEN

SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORP.

1759 North Broadway, Albany, N. Y.

N. Y. Office: 149 Broadway

...IN STOCK

AUTOMATICS

No. 515 National Acme, four spindle
No. 52 National Acme, four spindle
No. 53 National Acme, four spindle
1—¾" Gridley, four spindle
No. 454 New Britain four spindle 8" pneumatic chucks

BROACHES

No. XB10 Oilgear Hydraulic Twin Spindle
15 Ton Hercules Vertical

DRILLS

4' Prentice Radial
No. 17 Foote Burt, 2 spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gun Barrel, 2 spindle, m.d.

GEAR CUTTERS

No. 6 Fellows Gear Shaper
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS

10x20 Landis Cylindrical Hydraulic
12"x42" Landis Cylindrical
14"x72" Norton Cylindrical
16"x50" Norton Crankshaft
No. 55 Heald Cylinder
No. 60 Heald Cylinder
No. 2 Diamond Surface
No. 24—53" Gardner Disc

LATHES

17"x8' Sidney, c.d.
18"x6' Lodge & Shipley, c.d.
18"x9' Chard c.d.
17"x8' Wickes Production, c.d.
3½"x60" Fitchburg lo-Swing, g.h.
No. 9 LeBlond Multicut, g.h.

TURRET LATHES

No. 2B Foster, g.h.
No. 6A Potter & Johnston, g.h.
No. 2A Warner & Swasey, g.h.
2¼x24 Jones & Lamson, g.h.
3x36 Jones & Lamson, g.h.

MILLS, PLAIN

No. 3 Cincinnati, c.d.
No 2 Kent Owens, m.d.
No. 2 Kent Owens, p.f., m.d.
No. 8 S Becker Duplex, c.d.
No. 4 Hendey Lincoln Type. c.d.

MISCELLANEOUS

No. 227 Dreis & Krump Leaf Brake (12 ft.x⅜") m.d.
⅜"x18' Nilson Wire Straightener
Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill

PLANERS

22"x22"x6' Gray
30"x30"x8' Cincinnati
30"x30x8' Ohio
36"x36"x12' Woodward & Powell

TAPPERS

No. 14B Rickers Shafer
No. 1 Garvin
½" Rickert Shafer Radial

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1959-69 South Meridian Street
INDIANAPOLIS, INDIANA

Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

Why Retire Your Old Tools

We can rebuild them and modernize them for today's tasks at our new rebuilding plant, 432 Bryant Ave., Bronx—WOrth 4-7960. Send us full details—We will be glad to have our engineer inspect them and submit quotation.

PARTIAL LISTING OF MACHINES IN STOCK

Can Be Rebuilt and Motorized to Your Specifications

PLANERS:

BETTS 36"x36"10' Closed side
CLEVELAND 42"x42"x12' Closed side
D & H 48"x48"x21' Open side

TURRET LATHES:

J & L Hartness sliding head (1)
DRAPER 20" axel turning lathe

ENGINE LATHES:

LEBLOND 1¼" cap. adapted for turret
LODGE & DAVIS 1¼" capacity
PUTNAM 24"x16'
LODGE & SHIPLEY 16"x10' geared head
FLATHER 16"x6'
HENDEY 16"x6' Q.C. yoke head
DAVIS FURBER, H.D.

DRILLS:

PUTNAM Vert. 36"
DIAMOND 10" cap.
Comb. drilling, milling & tapping machine, Hor. or Vert.

CYL. GRINDERS:

#3 MODERN Universal (5)

SURF. GRINDER:

14" PRATT & WHITNEY ball bearing

BORING MILLS:

51½" Bickford boring mill

SHAPERS:

16" Steptoe
16" GOULD & EBERHARDT (2)
24" CINCINNATI, heavy duty

NORDBERG Diesel Electric power plant, complete, 440 H.P., direct connected to Crocker Wheeler Generator

Reconstruction Machine Tool Corp.

199 Centre St., New York, N. Y.

WOrth 4-7960

FALK *for* DEPENDABILITY

SHAPERS & SLOTTERS

15" HENDEY, Friction Drive (5), $450 ea.
20" CINCINNATI, Geared Crank, complete.
24" Stockbridge, Geared, Crank, Heavy, Cone dr.
20"x20"x24" N-B-P SHAPER-PLANER, Motor Dr.
12" New Haven Slotter; 32" Rotary Table.
7" Rhodes combination Shaper and Slotter, belt dr.

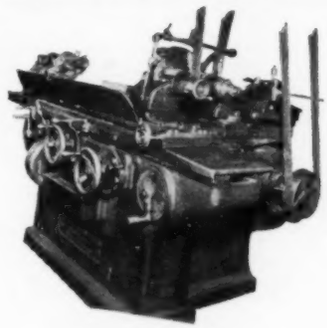
DRILL PRESSES—HIGH SPEED, BALL BEARING; SLIDING HEAD; SCREW EL. TABLES

4-Spindle Foot-Burt High Speed Ball Bearing with power feed to each spindle; automatic quick return, tight and loose pulley drive; 8" overhand No. 2 Morse Taper; table working surf, 14"x48".
1-Spindle Avey No. 3, 12" Overhang, No. 3 M.T. with Power feed; Ball Bearing.
1-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. with Power Feed; Ball Bearing.
2-Spindle Avey No. 2, 8" overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
3-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
2-Spindle Leland Gifford No. 2 M.T. 10" Overhang, Power feed to one Spindle.
2-Spindle KERN No. 2 M.T. 8" Overhang.
2-Sp. Henry & Wright, 8" Overhang, No. 2 M.T.
1-Sp. EDLUND No. 2B, 8" Overhang, No. 2 M.T.
1-SPINDLE ALLEN No. 2 M.T. 8" Overhang.
1-Spindle FOSDICK with TAPPING MECHANISM On SPINDLE No. 2 M.T. 8" Overhang.

PUNCH PRESSES

No. 18, 18C, 19, 19C, 20B Bliss, O.B.I.
No. 19 Truesdale OBI.
No. 4 Adriance OBI.
No. 46 MICHIGAN OBI.
No. 4 V & O—OBI.
No. 6 Waterbury Backed Geared, Open Back.
No. 73½ BLISS S.S. Plain flywheel.
No. 4 Bliss Back Flywheel Geared.
No. 2 BLISS Back Flywheel Plain, (6).
No. 1—Bliss Back Flywheel Plain.
No. 3R—Marquette Geared, Motor Dr.
No. 15N BLISS, arr. Geared, Motor dr. (2).
No. 25N BLISS Geared, Motor dr.; (3).
No. 1 BLISS S.S. Toggle Press.
No. 41 TOLEDO HORN PRESS, arr. Motor dr.
25 Ton Henry & Wright High Speed Press, dble. roll feeds.
No. 103S BLISS GANG DIE PRESS; Roll Feed.
No. 4½ BLISS three column Forging Press with Taper Rolls.
6 Ton General Flexible Press.
12 Ton Fox Flexible Press.
400 lb. Chambersburg board Drop Hammer.
1500 lb. Chambersburg Steam Hammer, single leg.
50 lb. DuPont Blacksmith Hammer.
15 lb. Bradley upright Strap Hammer.
No. 30 BLISS ARCH PRESS, Plain.
No. 25 NIAGARA ARCH PRESS, Plain.
No. 71 Waterbury Coining Press 25 Tons.
No. 93D TOLEDO DBLE. CRANK GEARED S.S. PRESS, Welded Frame.
No. 75 Toledo Open Back Plain Flywheel Press.
No. 16 Bliss Horn Press, 3" stroke, Motor Driven.
No. 2 Niagara OBI; No. 0 V & O (3).
No. 3 American Can Co. OBI.
No. 53 Perkins Sprue Cutter.
No. 5 Middleditch Sprue Cutter.
No. 1—100 lb. Standard Automatic Drop Hammer.
No. 702—BLISS TRIMMING PRESSES (2) Flat.
No. 4 Waterbury open back, rigid bed, plain.
520 Ton Southwark Hydraulic with Laurie Pump.
SHERIDAN EMBOSSING PRESS, 24x36.
#7H Cleveland HORN PRESS back geared, 8" stroke with screw elevating cable. 42 tons.
#39B Bliss HORN PRESS.
#4 Bliss, double crank GEARED PRESS, 4" stroke, bed 32x28.

A LIST OF FALL DEPENDABLE MACHINERY



DISC GRINDERS

Gardner No. 8—40" disc, 30" Ring Wheel, B.B. Belt Dr.
Gardner No. 4—20" Disc., 16" Ring Wheel, B.B. Belt Dr.
Badger No. 2—16" Disc, Double End, Univ. Tables, Belt.
Gardner No. 1—double end Disc, 12", B.B. belt dr.
GARDNER No. 14, Ball Bearing, double opposed, 20" discs.

20"x120" Landis Plain Cylindrical Grinder Self Cont'd, Motor drive, Serial 8034.

GRINDERS—Cylindrical

20"x120" LANDIS Self-Contained, Motor dr.
12x36" CINCINNATI Plain, Arr. Motor Dr.

AUTOMATIC CHUCKING MACHINES

2—No. 24 New Britain type 5 spindle.
1—No. 23 New Britain type 5 spindle.
1—J&L, HARTNESS AUTOMATIC CHUCKING LATHE; motor driven, 6"x12".

BROACHING MACHINE

Cincinnati SURFACE BROACHING MACHINE, model #5-54 duplex. New in 1937.

PUNCH & SHEARS

WICKES COMBINATION PUNCH AND SHEAR; MOTOR DRIVEN; 1¼" thru 1" Plate; Punching end 48" throat; Shearing end 36" throat; Continuous 6"x1" Plate.
LONG & ALLSTATER No. 2—24" Throat, arr. motor dr. Capacity 1" thru 1".
Niagara 36" foot Shear, 16 ga.
Kutscheid all steel 36"x16 ga. Foot Shear.
Pexto 48"x16 gt. Foot Shear.
Pittsburgh 36"x¾" Plate Shear, no holddown.
UNITED ENGINEERING Plate Shear 42"x3/16 no holddown.
No. 216D NIAGARA RING AND CIRCLE SHEAR, Motor Dr.
No. 236 PEXTO CIRCLE SHEAR, SPD; 16 ga.
No. 132 BLISS 14 ga., 12" throat, Slitter.
No. 232 Bliss 12 ga., 18" throat, Slitter.
12'x¾" and 6'x¾" STAMCO MILL PACK SHEAR.
BLISS 24"x16 ga. POWER SHEAR—Perfect for Tin Plate.

COILING MACHINES

No. 1 and No. 2 SLEEPER & HARTLEY BX CABLE COILING MACHINES ⅜ and ½" cap. Last used for Speedometer cable. Complete.

KEY SEATER

No. 3½ BAKER 72"x3" Cap. immediate delivery.

HAND SCREW MACHINE

#2 BARDONS & OLIVER, Geared Friction Head, Power feed to Turret, 1" Cap. fitted with complete automatic chuck and air cylinder.

INTERNAL GRINDER

GREENFIELD No. 12, HYDRAULIC FEED, Motor Drive; Cap. swings 15" Grinds automatically ⅜" to 5" dia.; 4" Deep; New in 1928.

MILLING MACHINES

No. 1 Cleveland, Motor Drive—$1,750.00. Coolant Pump, Motor $95.00 Extra. cap. 18" longit. feed 16" Vertical travel 8½" cross travel table working surface 8"x32"

No. 12 Pratt & Whitney Lincoln Production Miller.
No. 2 Pratt & Whitney Lincoln Production Mill.
1—3-H LeBlond Plain Miller, au. motor drive. Power feed all direction.

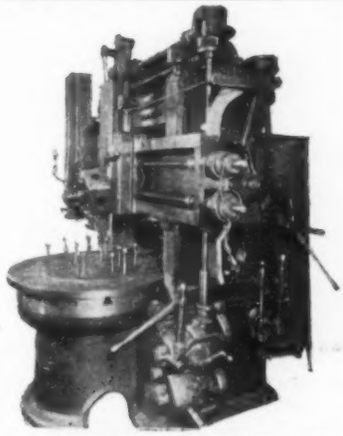
LATHES

42"x25' PUTNAM triple geared, 17'6" centers; Plain change gear, screw cutting.
36"x18' PRENTICE Lathe 9' Centers—Pl. chge. screw cutting, chuck and standard equipment.
22"x16' REED light Pattern, Pl. Change gear; 11" Centers, $750.
19x8 LEBLOND Production Turning Lathe
1—16"x8' American C.G. Lathe—au. M.D.
11"x4½' DAVIS pl. change screw cutting engine lathe; complete; $225.
10"x4' LOGAN (NEW) Lathes, Ball Bearing Spindle; ½" Collet capacity; arranged for motor drive; power cross feed; $225, f.o.b. factory; priority certificate required; shipment from stock.
7"x36" PRECISION BENCH LATHES — Hardinge, Sloan & Chase and others.
8"x108" FITCHBURG LO-SWING LATHE; SPD.
18"x12' HAMILTON pl. Change, Cone dr. chuck
11"x4' PRATT & WHITNEY TOOLMAKERS LATHE, Taper att.
16"x6' SOUTH BEND pl. Chge., Screw Cutting Engine Lathes (2).

TURRET LATHE

JONES & LAMSON 3x36 Double Spindle Very fine condition.

5" Bar BETTS Knee Type Horizontal Boring Mill, M.D.



COLD HEADERS
#22 Waterbury Farrell Cold Headers Dble stroke Solid Die also #11.

RADIAL DRILLS

DRESES 3' Arm. Plain Radial, Motorized; REBUILT —READY TO GO.
DRESES 4' Arm, Plain Radial, cone dr.

DIE CASTING MACHINES
3—MADISON-KIPP late model, 10"x12", 12"x14", 12"x16".

GEAR CUTTERS

No. 2 WHITON SPUR GEAR CUTTER, Auto.
36" Gould & Eberhart, "Victoria Model" perfect Cond.
48" Gould & EBERHART, Motor Driven; Complete; Perfect Cond.
No. 36B Gould & Eberhart Spur and Bevel Gear Cutter, Motor Dr.

HAMMOND 10 H.P. BUFFERS—8 months old. Motors in base, 3-60-220/440.

NEW LINES—WE SELL DREIS & KRUMP "CHICAGO" PRESS BRAKES AND BENDING BRAKES; STREINE POWER SQUARING SHEARS; BUFFALO DRILLS AND IRON WORKERS; CLEVELAND MILLING MACHINES; INDEX UNIVERSAL VERTICAL MILLERS; TROYKE ROTARY TABLES; L-W LATHE CHUCKS; INDEX HEADS; MAGNETIC CHUCKS AND HACK SAWS; VISES; OSWEGO MACHINISTS BENCH VISES; B-LINE MOTORS; VALLEY ELECTRIC GRINDERS; INQUIRIES INVITED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

MOREY
DEPENDABLE
USED MACHINES

ROCKFORD #2 Horiz. Boring Mill —floor type—M.D.
G. & E. 48" Gear Cutter
WHITON No. 15 Auto. Gear Cutter
INGLE 12" Gear Tooth Rounders
GLEASON 37" Bevel Gear Planer
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 6"-11"-18" Bevel Gear Generators
LEES BRADNER #5A Gear Generator
LANDIS 3½" Internal Hydraulic Race Grinder
LANDIS 16"x36" Plain Cyl. Grinder—M.D.
NORTON 14"x50" Plain Grinder —M.D.
HEALD No. 60 Internal Grinder
NORTON 16"x50" Crankshaft Grinder—M.D.
GARDNER No. 6 Dble. End BB Disc Grinder
GARVIN No. 3 Duplex Miller—S.P.D.
P. & W. 6"x132" Thread Miller
FELLOWS No. 4T Thread Generator
AUTOMATIC MACHINE CO. 12x4' Threading Lathe
BRIDGEFORD 27"x10' Boring Lathe
MONARCH 16"x10' Geared Head Lathe
FOOTE BURT No. 3 Rail Drill
P. & W. No. 12 Multi-Spindle Drill
NATCO C-13 Hyd. Multiple Spindle Drill
NATCO C-11C Multiple Spindle Drill
BLISS No. 31 Power Press
N.B.P. 400 ton Hyd. Wheel Press
ESPEN LUCAS No. 138 Cold Saw —Cap. 12" Rd.
NEWTON No. 197 & No. 200 Cold Saws
COCHRANE & BLY No. 5 Cold Saw
COULTER 2 spindle Diamond Borer—M.D.
LANDIS 4" Single Head Bolt Cutter
GRAY 30"x30"x8' Planer—2 heads on cross rail—M.D.
ACME 1" All Steel Upsetter
AJAX 3" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
KELLER E3 Auto. Profiler (Die Sinker)
ANDERSON Power Scraper
GISHOLT Precision Balancing Machine

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your Specific Inquiries

MOREY
MACHINERY CO., Inc.
510 BROOME ST., NEW YORK

EASTERN OFFERS

MILLING MACHINES
No. 2 Knight
Newton C17 Vertical Slab
6x14" Pratt & Whitney Thread
24"x24"x6' Ingersoll Slab
36"x36"x14' Bement Slab
40" Ohio Tilted Rotary

AUTOMATICS
⅜-½" Cleveland Model B, m.d.
⅞" Cleveland Model A
4 spindle ⅝" Cleveland Model M
1¼"-1½" Cleveland Model B
No. 6D Potter & Johnston Automatic

BOLT THREADING MACHINES
9/16" Landis 2 spindle, m.d.
2 spindle 1" Acme Class A
3 spindle 1" Acme
1" Landis
2" Landis
2½" Acme
No. 11 S. Rickert-Shafer Auto. Threading
1¼" American Bolt Heading

PIPE THREADING MACHINES
No. 2 Bignall & Keller, m.d.
2" Bignall & Keeler, belt
2" No. 70 Jarecki, m.d.
No. 4 Bignall & Keeler, m.d.
4" Eaton, Cole & Burnham, belt
4" Merrell, belt
6" Oster, m.d.
15" Cox, belt

WELDERS
30 KW Federal Spot, type No. 34 8B, cap. 2 pcs. ¾"
200 amp. Lincoln Stable Arc
300 amp. Lincoln Stable Arc
300 amp. General Electric Arc
300 amp. Hobart Arc with Chrysler Engine

PLAIN CYLINDRICAL GRINDERS
10x18" No. 14 Brown & Sharpe
10x24" Landis, m.d.
10x30" Queen City, m.d.
10x36" Landis Integral Cam, m.d.
10x36" Norton, m.d. (5)
10x50" Norton, m.d.
10x52" Landis, m.d.
10x72" Norton, m.d.
12x36" Cincinnati, m.d.
12x36" Cincinnati, belt
12x36" Modern, belt
12x36" Modern, m.d.
12x42" Landis, belt
12x48" Modern, m.d.
14x50" Norton, m.d.
18x72" Cincinnati Automotive Parts, m.d.

UNIVERSAL CYLINDRICAL GRINDERS
12x42" Modern, belt

GRINDERS
Cincinnati Valve Seat Grinder, 2 m.d.
No. 10 Bryant Internal
No. 50 Heald Cylinder, hydraulic
No. 55, 60, 65 Heald Cylinder
No. 1 Fraser Lapper
54" Bridgeport Knife
No. 4 Gardner Disc
No. 6 Diamond Disc
No. 20 Gardner B.B. Combination Disc and Sander
No. 120 Gardner Double Disc
No. 120 Gardner Combination Disc
Rockford Wet Emery Grinder
Springfield Wet Emery Grinder, m.d.
Hisey-Wolf B.B. Polishing Stand, m.d.
Mitchell Type A1 Polishing Stand
U. S. Elec. Tool Polishing Stand, m.d.

TOOL & CUTTER GRINDERS
Gisholt Universal Tool Grinder, belt
Gleason Cutter Grinder, belt
Gould & Eberhardt Gear Cutter Grinder, belt
Modern Chaser Grinder, belt
Yankee Drill Grinder, belt

Many other machines in stock.
Let us quote on your requirements.

The
EASTERN
MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

LATHES
9"x18" Porter Cable Lathe (2)
No. 324 Adriance Spinning
26"x10' LeBlond, Universal Crankshaft

MILLING MACHINES
2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote Burt Surface Broach
New No. 3 Wigglesworth

TURRET LATHES
4D Potter & Johnstons (2)
2¼" & 24" Jones & Lamson steel HD. M.D.
3x36 Jones & Lamson steel Hd. M.D.
2 spindle Jones & Lamson steel Hd., M.D.
Goss & De Leeuw Chucking, 6"x6½"

RADIAL DRILLS
3' Carleton No. B-16 Natco Multiple Spindle

GEAR MACHINERY
No. 61 Fellows
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder

MISCELLANEOUS
15 KVA. Taylor Spot Welders
No. 1 Foote-Burt Duplex Surface Broach
8" Welland Standard Pipe Machine
No. 4 Hilles & Jones Double End Punch and Shear
No. 363 Bliss St. Side Gd. M.D.
No. 23 Steel Herning Press
2" Acme Bolt Threader

WIGGLESWORTH MACHINERY CO.
203 Bent St., Cambridge, Mass.

GRINDERS
20"x144" Landis, plain, cylindrical; motorized.
12"x36" Pratt & Whitney, surface; belt drive.
18" Gorton double end Disc, belt drive

BUFFERS
6—6 HP Van Dorn Buffers, 220/3/60 motor 72x1¼ spindle

THE O'BRIEN MACHINERY CO.
OFFICE: **113 NORTH THIRD STREET**
PHILADELPHIA, PA.

96 INCH GLEASON
STRAIGHT BEVEL
GEAR PLANER

Motor Driven. With Standard Equipment and large Assortment of Cutting Tools

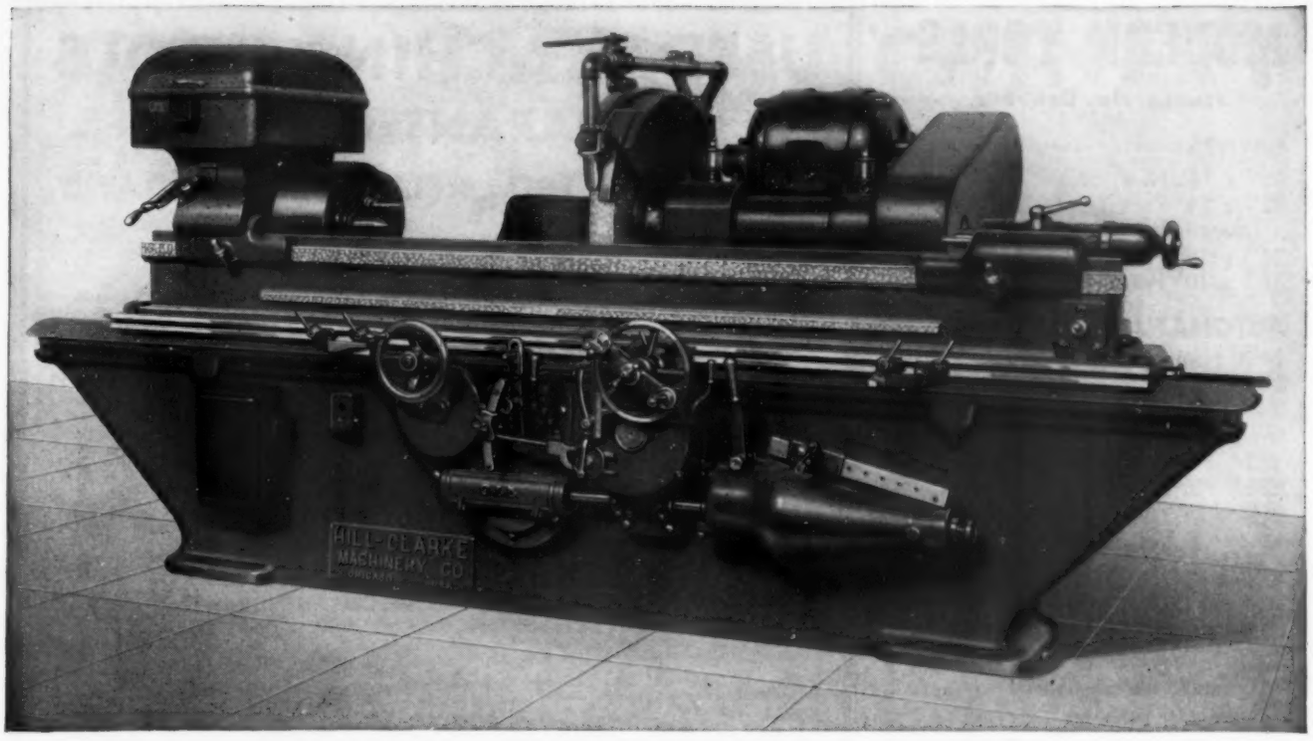
INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
Indianapolis, Indiana

AUTOMATIC, 1¼" Cleveland Model B #34 New Britain Chucker
GRINDERS, #2 Churchill Internal, can grind 30" deep, dist. center of spin. to top of table 18"; 30" x 240" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.; 10" x 24" Norton Cyl. M.D.; No. 25A Heald, 30" Rotary Surface, M.D.; #3 Cinci. Centerless, M.D.
GEAR CUTTERS—60" x 12" Gould & Eberhardt, Spur; 11" Gleason Bevel Gear Generators (2). 36" G & E Spur and Bevel. 8" Hercules Hobber.
KEYSEATERS—#3 Baker, 26" stroke x 3" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M., 19" stroke x 2½" wide; #1 Davis.
MILLING MACHINES—#3 Lees Bradner Thread Miller; Model D Hall Planetary Thread Millers; #6 Jackson Die Sinker or Vertical Miller. #4 Cinci. Vert. M.D.
PLANERS—60" x 48" x 14' Bertram Openside, 3 hds., DC Reversing M.D.; 26" x 8' Gray, 1 head.

ROSENKRANZ MACHINERY CO.
30 Church Street **New York, N. Y.**

No. 2 Pratt & Whitney Shaving Machine
14" P & W Vertical Grinder, M. D.
300-ton Dunning & Boschert Tire Press
52" x 8' New Haven Lathe

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road **Rochester, N. Y.**



HILL-CLARKE MOTOR DRIVEN GRINDERS

. . . *featuring the* PATENTED MULTIPLE V-BELT WORK HEAD *and* OTHER HILL-CLARKE DEVELOPMENTS WHICH ASSURE *Super Grinding, Micro-Finish and Precision*

SIZES AVAILABLE

	10x72	14x72
10x36	14x36	16x50
10x50	14x50	16x72

Micro-finish (a surface finish so perfect that it must be measured in micro inches) is obtained on Hill-Clarke Motor Driven Grinders with a standard grain free cutting wheel and with the same procedure as followed in commercial grinding.

Micro-finish is within precision limits and requires no extra grinding time.

HILL-CLARKE *Production* UNIVERSAL GRINDERS

Designed for the heavy work required of a production machine yet universal enough for use on jobs requiring several different types of grinders. Can be converted quickly to do plain cylindrical, internal, rotary surface grinding.

SIZES AVAILABLE

12x36
12x50
12x72

Established 1867

HILL-CLARKE MACHINERY CO. CHICAGO U.S.A.

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD, CHICAGO, ILL.

PHONE: HAYMARKET 7660 CABLE ADDRESS: "REMAND"

MODERN TOOLS

Immediate Delivery

LATHES

52" x 14' New Haven Q. C.
42" x 24' Putnam triple back geared, face plate
38" x 18' Prentice G. H.
18" x 10' Prentice G. H.

AUTOMATICS

#55 National Acme M.D.
2" Cleveland
2—4 spindle New Britain Chucking Machines
#5A Potter & Johnson
#6A Potter & Johnson
2¼" x 24" J. & L.
Model G ⅞" Capacity Gridley

GEAR CUTTERS

36" Fellow
#26 Brown & Sharpe
#3 Newark Spur
18" Gould & Eberhardt Spur & Bevel

RADIAL DRILLS

6' Prentice Gear Box, M.D.
3½" Prentice

VERTICAL MILLERS

#4B Becker
#5B Becker
Becker #6
1—#4 Horizontal Brown & Sharpe

SHAPERS

14" Chase
16 and 20" Steptoe
24" Gould & Eberhardt

BORING MILLS

44" Rogers
36" Niles
30" Niles

GRINDERS

12 x 72 Brown & Sharpe
12 x 24 Cincinnati Universal

MISCELLANEOUS

Slotters

8"-14"-16" Newton Vertical

Forming Rolls

Heavy Duty 5 Sets & 3 Sets

1—Chambersburg steam or air hammer 1000 lbs.
1—4 x 4½ Oaking punch & shear
1—40 lb. Bradley Hammer
1—Lees Braddner Thread Miller

This is only a partial list

S. & S. MACHINERY CO.
207 CENTRE STREET
NEW YORK, N. Y.
CAnal 6-2724

USED MACHINE TOOLS
GUARANTEED BY
A TIME TESTED, RELIABLE COMPANY

DRILLS

1 spdl. Henry & Wright
1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
2 spdl. Henry & Wright
4 spdl. Henry & Wright
4 spdl. Sigourney
4 spdl. Woodward & Rogers
2 spdl. Baker Cylinder Borer

DRILLS (RADIAL)

4' Western

GEAR CUTTERS

No. 4—48" Brown & Sharpe

GRINDERS

Hill-Clarke Production Universal
12x36 12x50 12x72

(See page 207 special advertisement Hill-Clarke Cylindrical Grinders)

No. 40 Bryant Plain, Wide Wheel, Oscillating
No. 10 Lees-Bradner Spur Gear Grinder
No. 5 Springfield Planer Type Surface
No. 18 Bryant Internal
No. 60 Heald Cylinder
1½" dia. New Yankee Drill Grinder

LATHES

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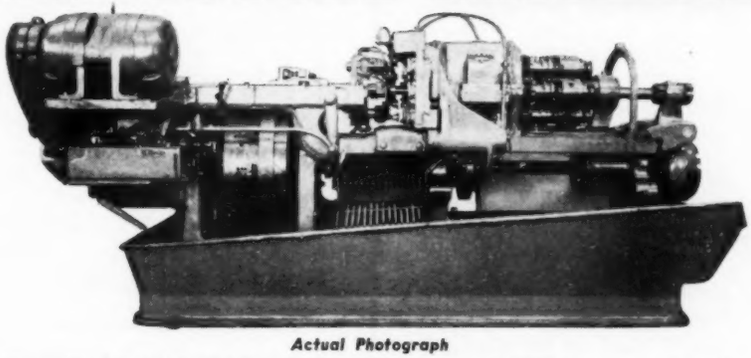

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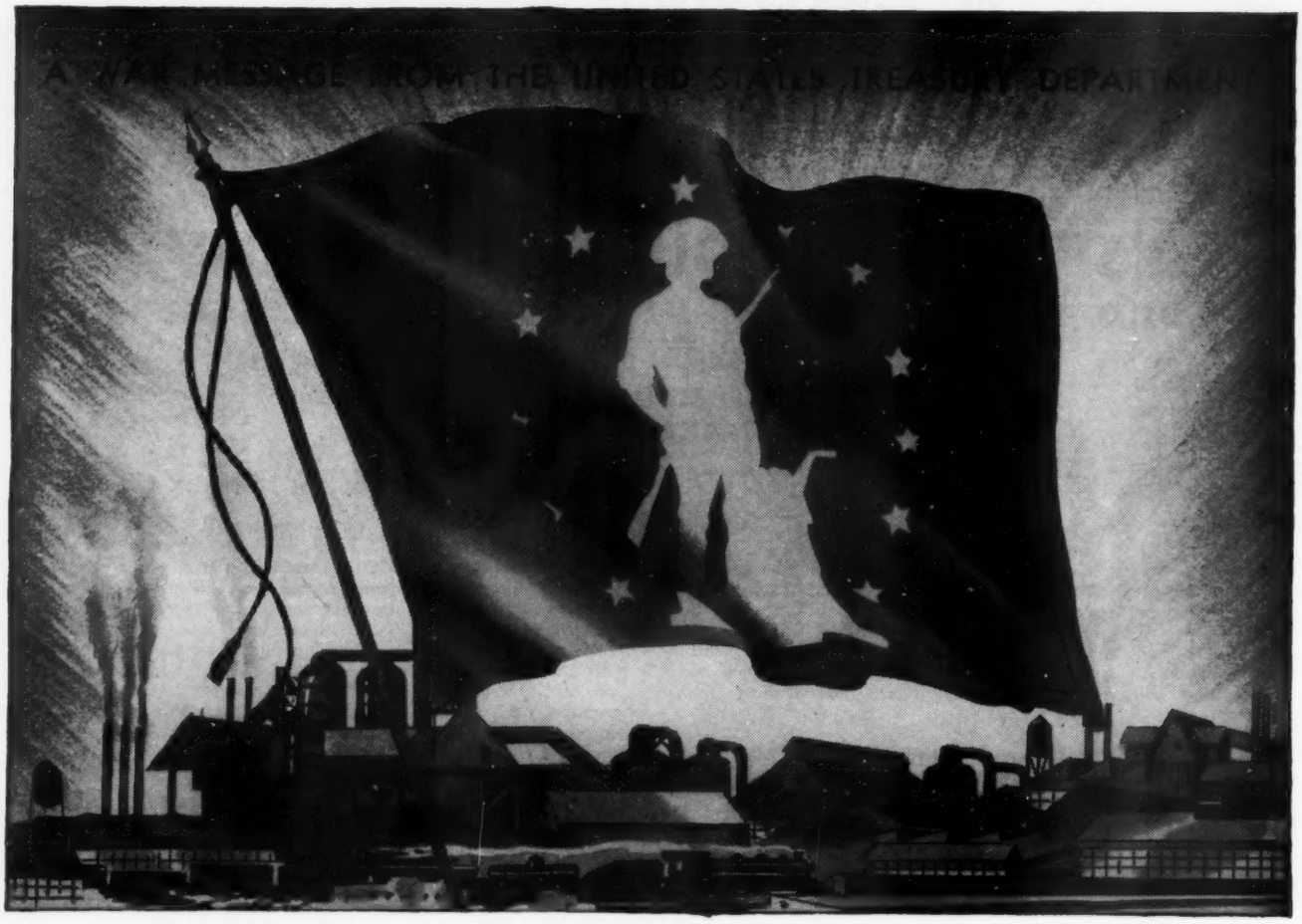

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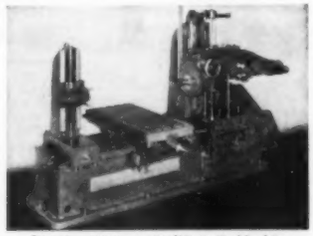

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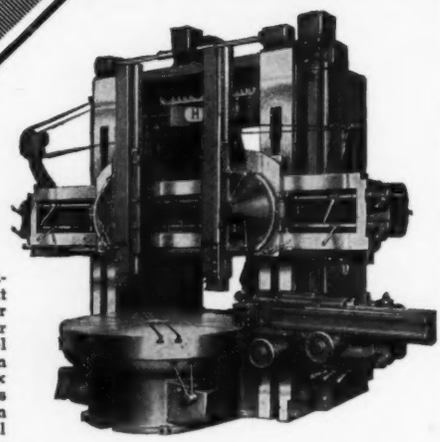

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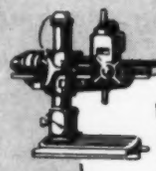

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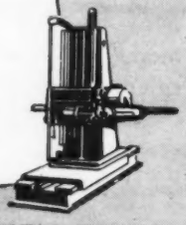

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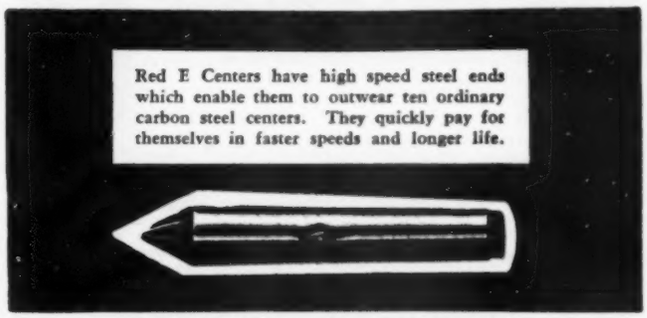
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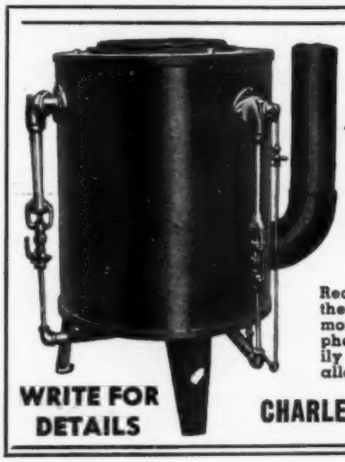

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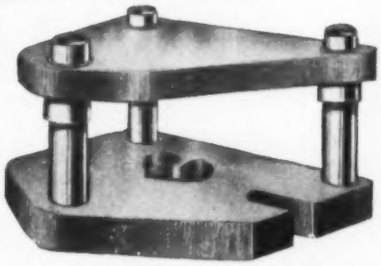

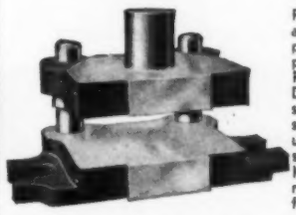

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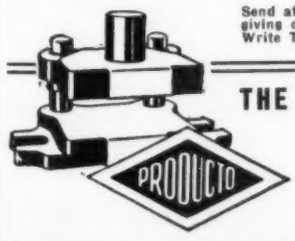

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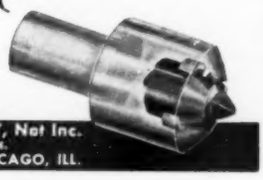

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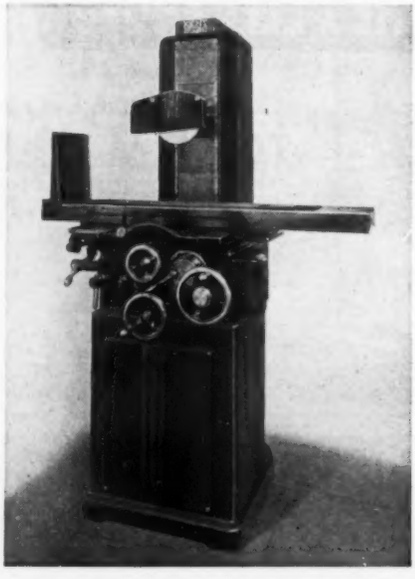

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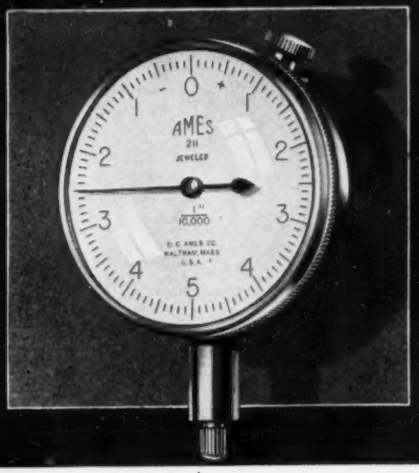

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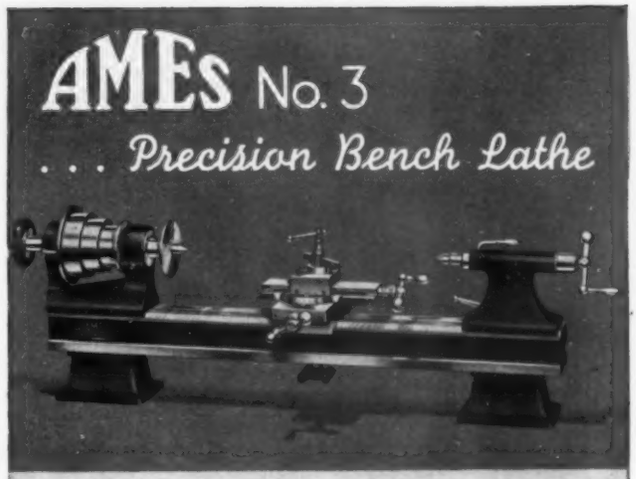

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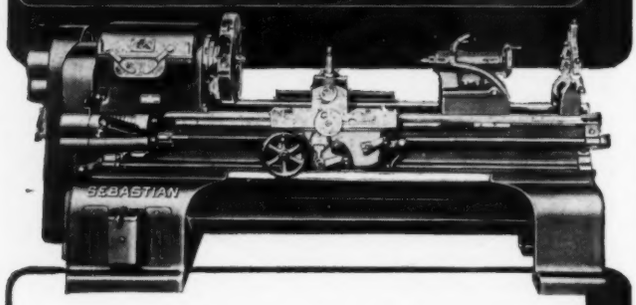

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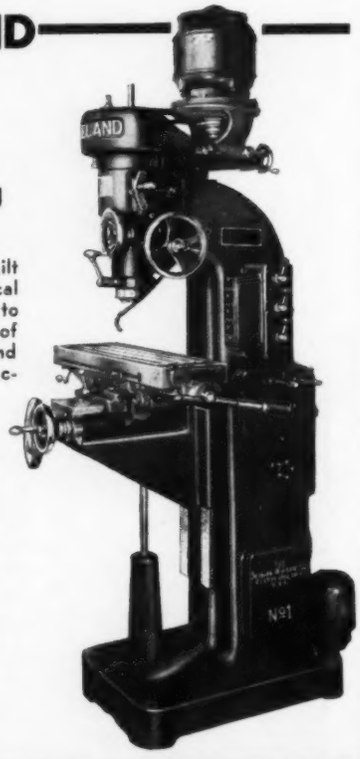

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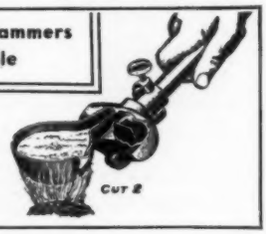
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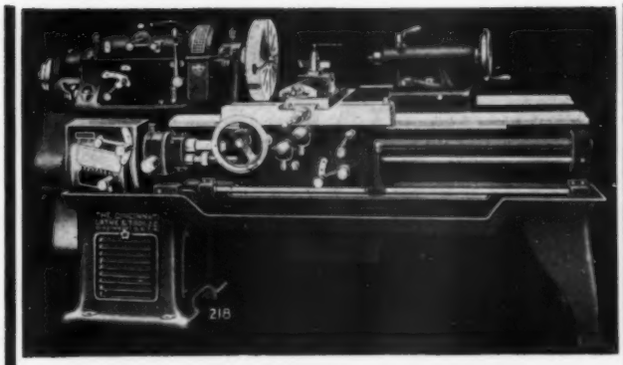

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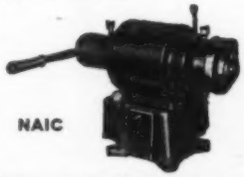
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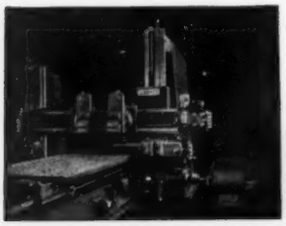

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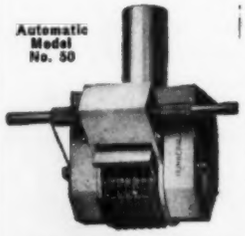

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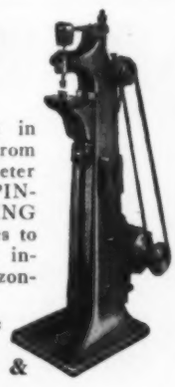

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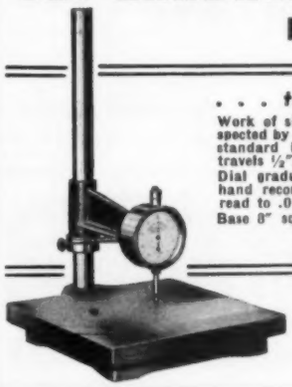

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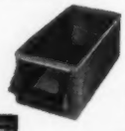

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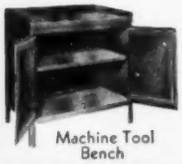

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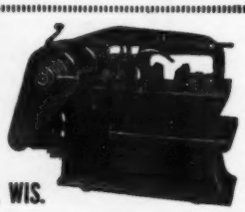

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SCREWS, Shoulder
Allen Mfg. Co., Hartford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTING
Jones & Laughlin Steel Corp., Pittsburgh
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Haskins Co., R. S., Chicago

SHAPERS
American Tool Wks. Co., Cincinnati
Bryant Machinery & Engineering Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Machine Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Manufacturing Co., Los Angeles, Calif.
Ohio Machine Tool Co., Kenton, Ohio
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith & Mills Co., Cincinnati, Ohio

SHAPES, Structural Steel
Jones & Laughlin Steel Corp., Pittsburgh

SHARPENING STONES
Carborundum Co., Niagara Falls, N. Y.

SHEARS, Hand
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Power
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

SHEAVES, V Belt
Allis-Chalmers Mfg. Co., Milwaukee

SHEET METAL WORKING MACHINERY
Cincinnati Shaper Co., Cincinnati
O'Neil-Irwin Mfg. Co., Minneapolis

SHEET & TUBE, Formed
Makepeace Co., D. E., Attleboro, Mass.

SHELL MAKING MACHINERY
Bullard Co., Bridgeport, Conn.
Coulter Machine Co., James, Bridgepart, Conn.

SHIELDS, Welding
Lincoln Electric Co., Cleveland

SHIPPING BAGS
Ames Bag Co., Cleveland

SHOP EQUIPMENT
Lyon Metal Products, Inc., Aurora, Ill.

SLOTTING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Douglas Machy. Co., Inc., N. Y. C.

SOCKETS
Cleveland Twist Drill Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SOCKETS, Detachable Head
Armstrong Bros. Tool Co., Chicago
Owatonna Tool Co., Owatonna, Minn.
Williams & Co., J. H., Buffalo, N. Y.

SOLENOIDS
Allen-Bradley Co., Milwaukee

SPECIAL MACHINES
Coulter Machine Co., James, Bridgeport, Conn.
Nilson Machine Co., A. H., Bridgeport, Conn.
Snyder Tool & Engineering Co., Detroit, Mich.

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Adams Co., Dubuque, Iowa
Earle Gear & Machine Co., Philadelphia, Pa.
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Grant Gear Works, Boston, Mass.
Stahl Gear & Machine Co., Cleveland
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SPEED REDUCERS, Motorized
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SPINDLES, Grinding
Excello Corp., Detroit

SPOT WELDER CONTROL
General Electric Co., Schenectady, N. Y.

SPROCKETS
Grant Gear Wks., Boston, Mass.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

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STARTERS, Motor
Lincoln Electric Co., Cleveland

STEEL, Alloy
Wheelock, Lovejoy Co., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Alloy Cold Drawn
Carpenter Steel Co., Reading, Pa.
Wheelock, Lovejoy Co., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Carbon
Carpenter Steel Co., Reading, Pa.
Timken Roller Bearing Co., Canton, Ohio
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Cold Finished
Jones & Laughlin Steel Corp., Pittsburgh
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, High Speed
Armstrong Bros. Tool Co., Chicago
Carpenter Steel Co., Reading, Pa.
Vascoloy Ramet Division of Vanadium Alloy Steel Co., Chicago

STEEL, Screw
Jones & Laughlin Steel Corp., Pittsburgh
Wyckoff Drawn Steel Co., Pittsburgh

STEEL SETTERS
Errington Mech. Lab., Staten Island, N. Y.

STEEL, Stainless
Carpenter Steel Co., Reading, Pa.

STEEL, Tool
Armstrong Tool Co., Chicago
Bissett Steel Co., Cleveland
Carpenter Steel Co., Reading, Pa.
Wheelock, Lovejoy Co., Cambridge, Mass.

STEELS, Alloy Carbon & High Speed
Bethlehem Steel Co., Bethlehem, Pa.
Ingersoll Steel & Disc Div. of Borg Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Timken Steel & Tube Co., Canton, Ohio

STEELS, Stainless
Ingersoll Steel & Disc Div. of Borg Warner Corp., New Castle, Ind.

STRAIGHT EDGES
Brown & Sharpe Mfg. Co., Providence, R. I.

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Taylor Wilson Mfg. Co., McKees Rocks, Pa.

STRAIGHTENING MACHINERY
Springfield Mach. Tool Co., Springfield, Ohio

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Aluminum Co. of America, Pittsburgh

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Modern Tool Works, Rochester, N. Y.

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Danly Mach. Specialities Co., Inc., Chicago, Ill.
Waltham Machine Works, Waltham, Mass.

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Lombard Governor Corp., Ashland, Mass.
Machine Products Corp., Detroit

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Etna Machine Co., Toledo, Ohio
Torrington Co., Torrington, Conn.

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Clark Controller Co., Cleveland

SWITCHES, Electric, Limit, Safety
Allen-Bradley Co., Milwaukee

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Aluminum Co. of America, Pittsburgh

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TAP EXTENSIONS
Allen Mfg. Co., Hartford, Conn.

TAP HOLDERS
Errington Mech. Lab., Staten Island, N. Y.

TAPER PINS
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Avey Drilling Machine Co., Cincinnati, Ohio
Barber-Colman Co., Rockford, Ill.
Baush Machine Tool Co., Springfield, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Errington Mech. Lab., Staten Island, N. Y.
Ettco Tool Co., Brooklyn, N. Y.
Haskins Co., R. G., Chicago, Ill.
Kingsbury Mach. Tool Corp., Keene, N. H.
Murchey Machine & Tool Co., Detroit

TAPPING MACHINES, Single & Multi-Spindle
Baker Brothers, Inc., Toledo, Ohio
Baush Machine Tool Co., Springfield, Mass.

TAPS AND DIES
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Geometric Tool Co., New Haven, Conn.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Ground
Card Mfg. Co., S. W., Mansfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.

TAPS, Collapsing
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.

TESTING APPARATUS, Hardness
Shore Instrument & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Instrument Co., New York, N. Y.

THREAD CHECKING EQUIPMENT
Cadillac Gage Co., Detroit

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Dalsen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Excello Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
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Waltham Machine Works, Waltham, Mass.
Warner & Swasey Co., Cleveland

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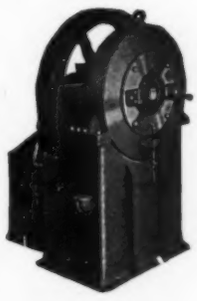

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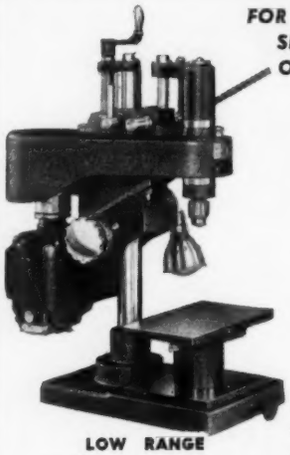

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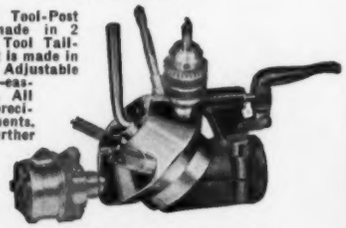

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Sturdimatic Tool Co., Detroit, Mich.
Warner & Swasey Co., Cleveland, Ohio
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TOOL WORK
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOLS, Boring
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Bullard Co., Bridgeport, Conn.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
McKenna Metals Co., Latrobe, Pa.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Carbide Alloy
Crafts & Co., Inc., Arthur A., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Tungsten Electric Co., North Bergen, N. J.
Vascoloy Ramet Division of Vanadium Alloy Steel Co., Chicago
Warner & Swasey Co., Cleveland

TOOLS, Cemented Carbide
Gairing Tool Co., Detroit

TOOLS, Cutting
Gairing Tool Co., Detroit
National Tool Co., Cleveland

TOOLS, Cutting-Off
Armstrong Bros. Tool Co., Chicago
Auto-Ordnance Corp., Bridgeport, Conn.
Empire Tool Co., Detroit
Jones & Lamson Machine Co., Springfield, Vt.
McKenna Metals Co., Latrobe, Pa.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond Tipped
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co. (Not Inc.), Chicago
Smit & Sons, Inc., J. K., N. Y. C.

TOOLS, Hand
Capewell Mfg. Co., Hartford, Conn.
Gairing Tool Co., Detroit
Starrett Co., L. S., Athol, Mass.

TOOLS, Knurling
Armstrong Bros. Tool Co., Chicago
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Lathe
Auto-Ordnance Corp., Bridgeport, Conn.
Bullard Co., Bridgeport, Conn.
Cleveland Twist Drill Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
McKenna Metals, Latrobe, Pa.
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Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Tungsten Carbide Tipped
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Warner & Swasey Co., Cleveland

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Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Turret Lathe and Screw Machine
Armstrong Bros. Tool Co., Chicago
Auto-Ordnance Corp., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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TRANSMISSION, Variable Speed
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TRUCKS, Steel
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Starrett Co., L. S., Athol, Mass.

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Covel Mfg. Co., Benton Harbor, Mich.
Fenn Mfg. Co., Hartford, Conn.
Hartford Special Machy. Co., Hartford, Conn.
Johnson Tool Co., East Providence, R. I.
Sheldon Machine Co., Chicago

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VISES, Milling Machines
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Kearney & Trecker Corp., Milwaukee
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Progressive Welder Co., Detroit
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WRENCHES, Socket
Armstrong Bros. Tool Co., Chicago
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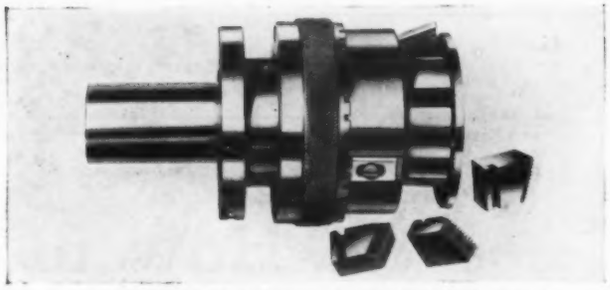
WRENCHES, Tap
Card Mfg. Co., S. W., Mansfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.



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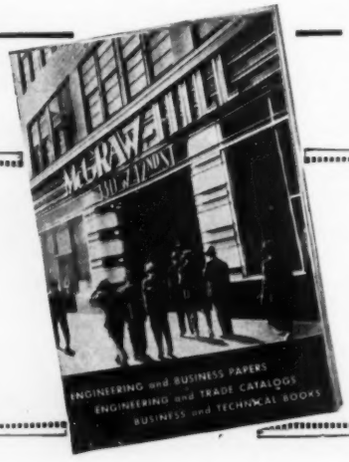

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"---and at the risk of seeming impatient we beg to inquire where in hell is our lathe?"

Yours very truly,

V. R. Inahurry

Your LeBlond Lathe, sir, will be shipped tomorrow. When you get it, you will find that it is the same precision tool that you have always associated with the LeBlond name. Conceivably it could have been shipped yesterday — if we had been willing to compromise with hair-breadth accuracy. We weren't and it wasn't.

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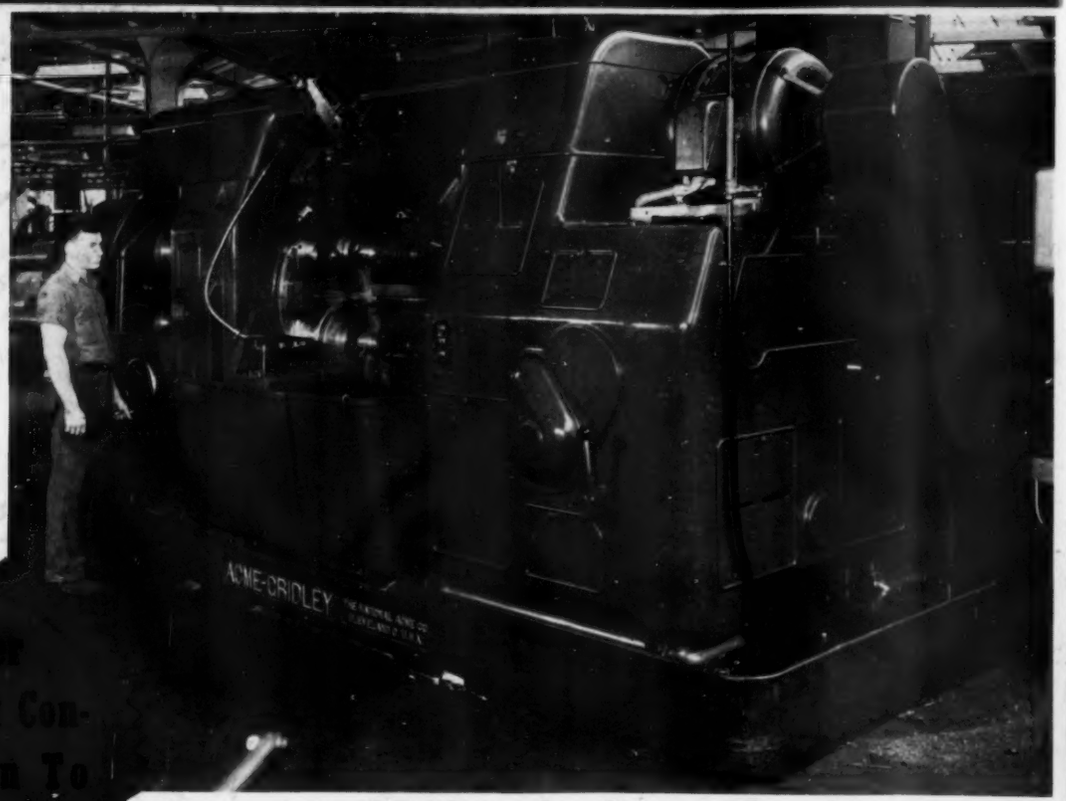

Largest Multiple-Spindle Automatic Screw Machine Ever Built Goes Into Service On Timken Bearings To Make Timken Bearings

This 8" Acme-Gridley 4-Spindle Automatic Screw Machine designed and built by The National Acme Company, Cleveland, Ohio, is the latest and greatest addition to a famous line and will considerably increase our already greatly expanded facilities for the production of Timken Tapered Roller Bearings to meet the constantly growing requirements of the war program.

Besides having the largest capacity of any machine of its kind, it embodies the extremely high standard of precision demanded in the manufacture of Timken Bearings.

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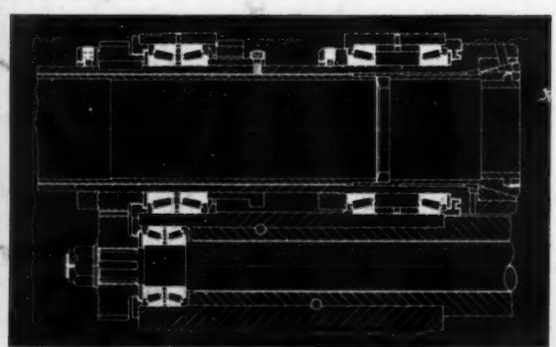

Application of Timken Bearings to spindles and drive shaft of the 8" Acme-Gridley Multiple Spindle Automatic Screw Machine. These bearings are 14" outside diameter.

With its excellence of design, superb construction and liberal use of Timken Bearings, this new Acme-Gridley Automatic is an outstanding achievement in the machine tool field.

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